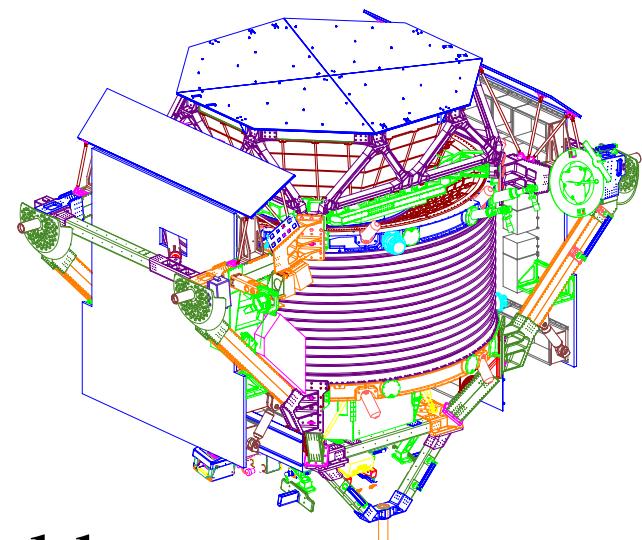
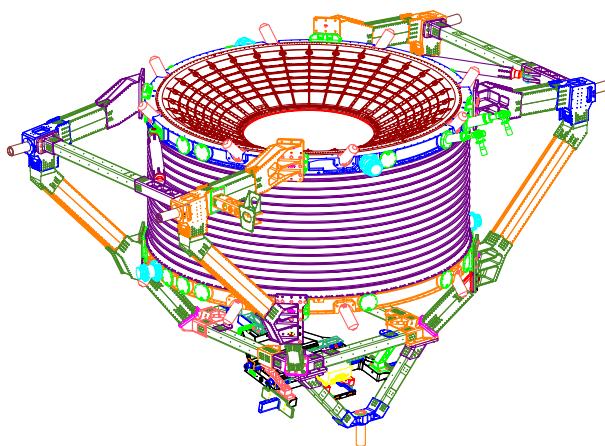




Unique Support Structure (USS) - 02 and Flight Hardware Integration



Ross A. Harold

Lockheed Martin Space Operations



Contents

- USS-02 Requirements
- USS-02 Design Features
- Shuttle Interfaces
 - Trunnions
 - Orbiter Envelopes
 - Flight Releasable Grapple Fixture (FRGF)
 - Remotely Operable Electrical Umbilical (ROEU)
Payload Disconnect Assembly (PDA)
- ISS Interfaces
 - Payload Attach System
 - Berthing Camera System (BCS)
 - Power Video Grapple Fixture (PVGF)
 - EVA Handrails and WIF
 - EVA Interface Panel



Contents (continued)

- AMS-02 Experiment Interfaces
 - Transition Radiation Detector (TRD)
 - Upper Time of Flight (Upper TOF)
 - Tracker
 - Anti-Coincidence Counter (ACC)
 - Lower Time of Flight (Lower TOF)
 - Ring Imaging Cherenkov Counter (RICH)
 - Electronic Calorimeter (ECAL)
 - Main Radiators + Crates



Contents

(continued)

- AMS-02 Experiment Interfaces (continued)
 - RICH & ECAL Crates Radiators + Crates
 - Tracker Radiators
 - Cryomagnet Avionics Box (CAB)
 - Tracker Thermal Control System (TTCS) Box
 - TRD Gas Supply System (UGBS)
 - TRD Gas Circulation System (UGBC)
 - Cryomagnet Discharge System
 - Uninterruptible Power Source (UPS)
 - Cryogenic Valve Box (CVB) and Warm Helium Supply Box



USS-02 Requirements

- Integrate the AMS-02 Experiment to Shuttle and Station per Program Requirements Document and Project Management Plan for the AMS Payload Integration Hardware (PIH) (JSC-27296 / LMSEAT-31947)
- Interface with the AMS-02 Experiment Components per the AMS-02 Experiment/PIH Interfaces (JSC-29095)



USS-02 Requirements (continued)

- Structural requirements per AMS Structural Verification Plan (SVP) JSC 28792
- Corrosion Control Plan developed with Rajib Dasgupta of LM/Materials
- Interface with Space Shuttle per the Space Shuttle Core ICD (NSTS-21000-IDD-ISS)

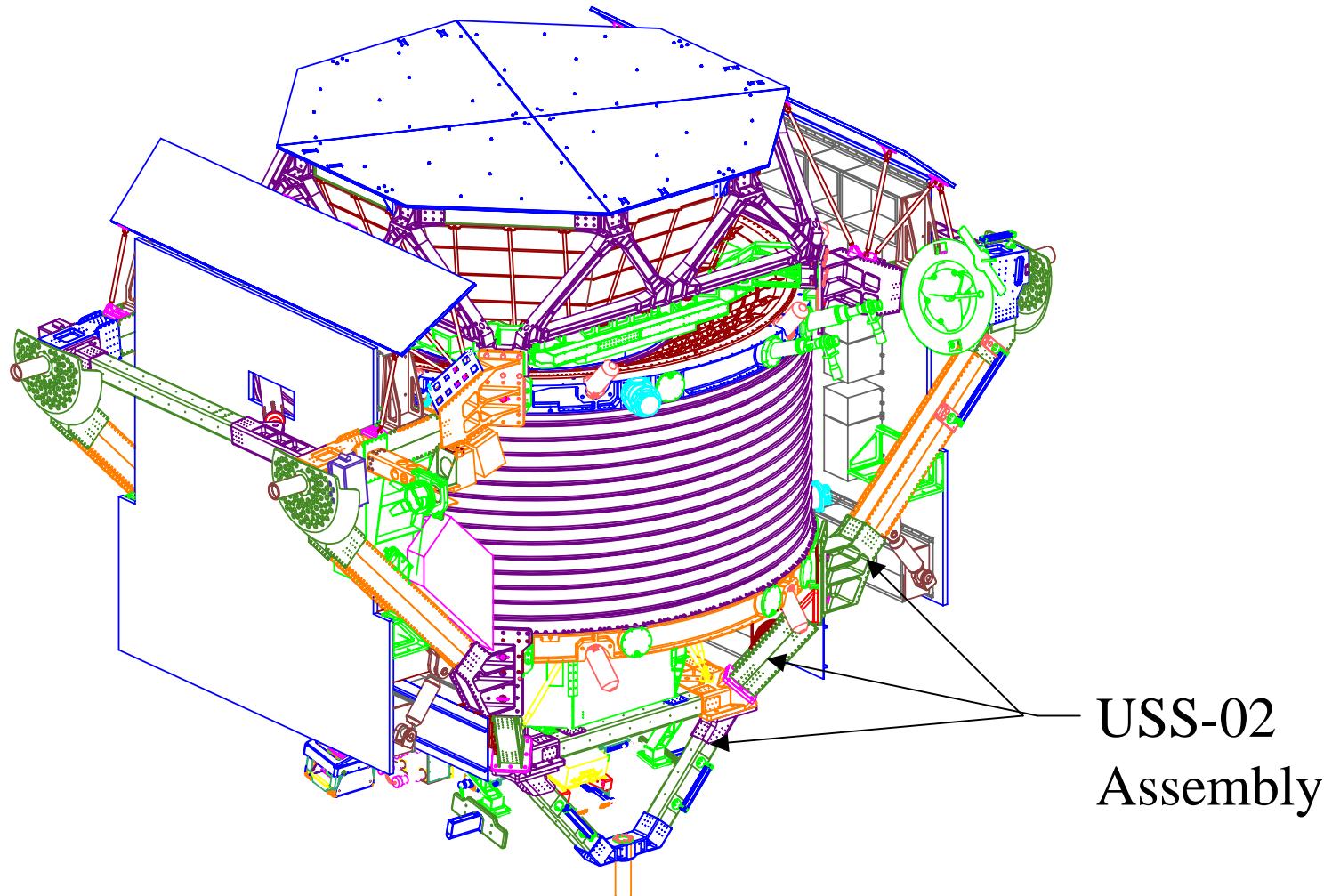


USS-02 Requirements (continued)

- Interface with ISS per the Attached Payload Interface Requirements Document (SSP57003)
- Protect payload safety critical components from Micro Meteoroid and Orbital Debris (MMOD) per SSP57003

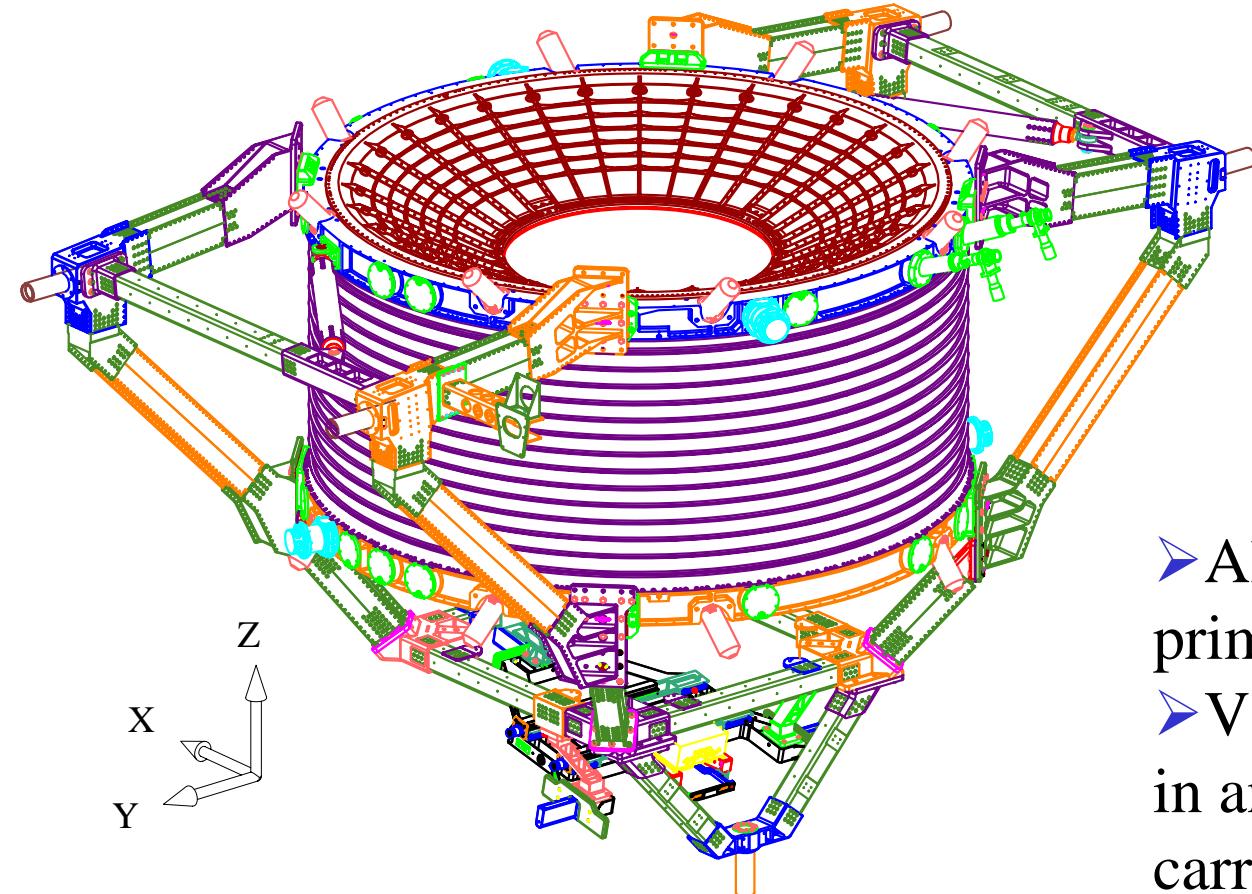


USS-02 Design Features



The USS-02 Assembly is an integral structural component of the
AMS-02 Payload Assembly

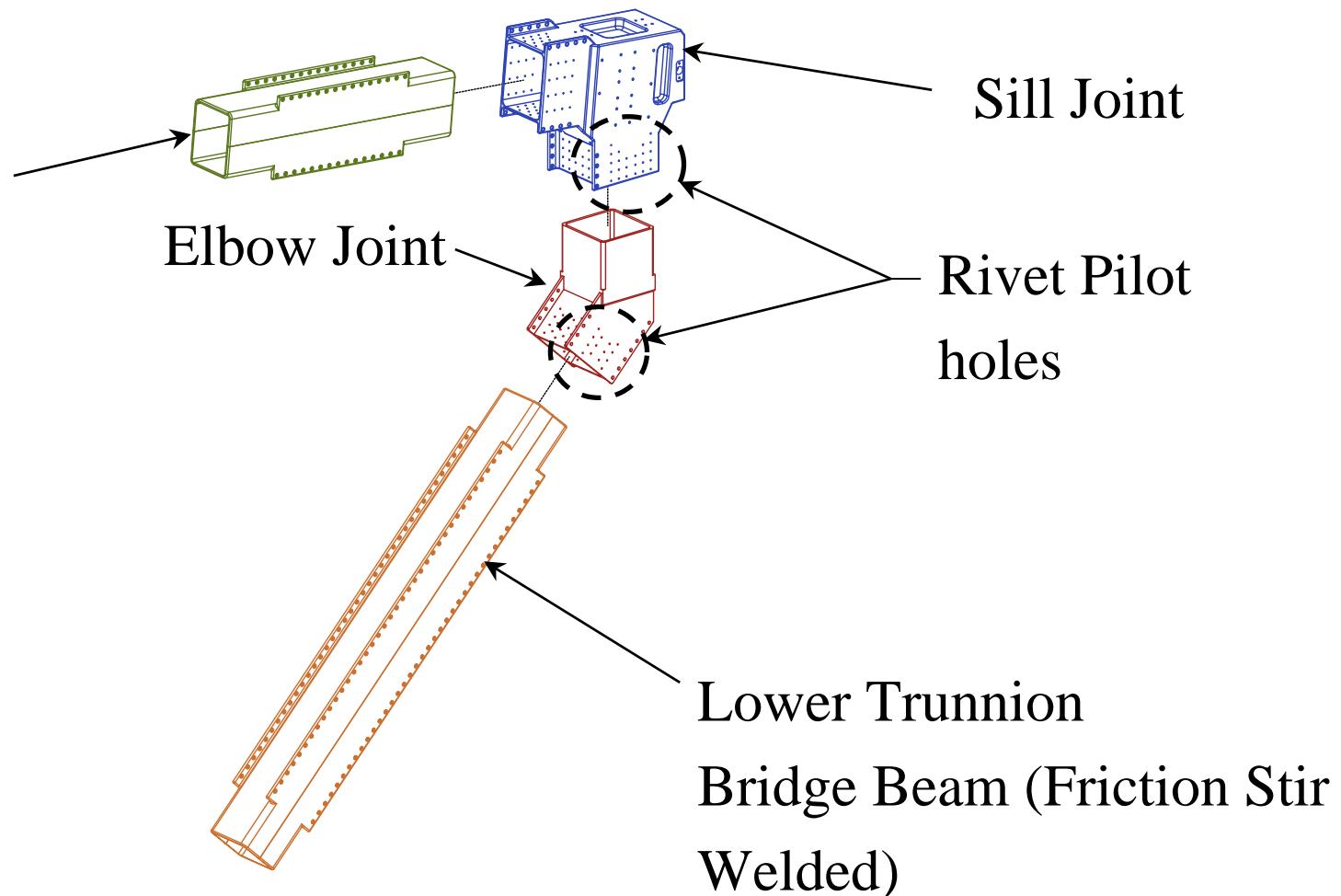
USS-02 Design Features



- All aluminum alloy primary structure
- Vacuum Case (VC) in an integral, load carrying part of the structure

USS-02 Design Features

Upper Trunnion
Bridge Beam
(Friction Stir
Welded)



USS-02 Rivet box beam construction



USS-02 Design Features





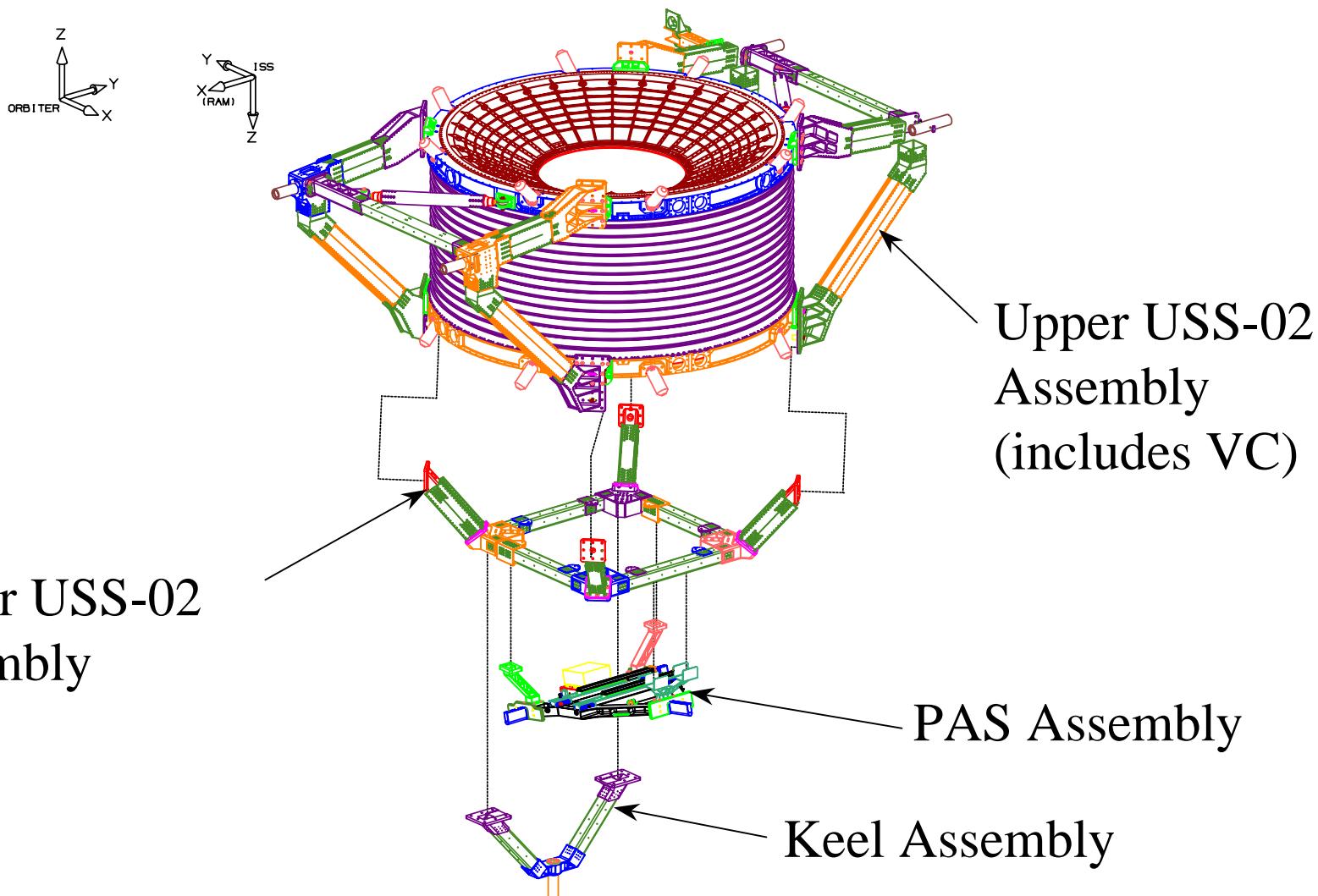
USS-02 Design Features



Completed Test Beams



USS-02 Design Features



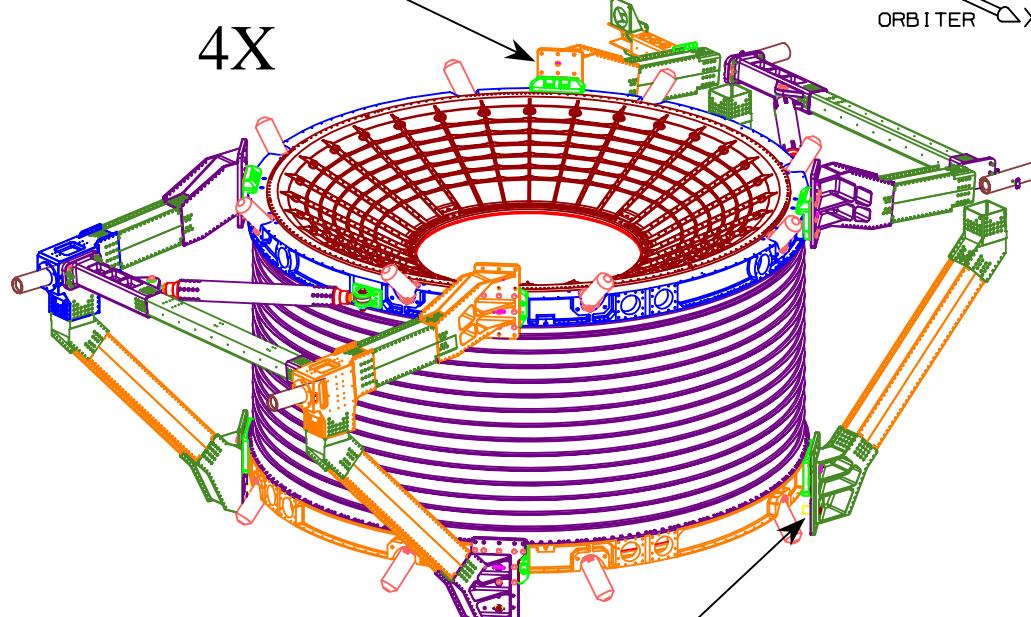
USS-02 bolted and separable subassemblies



USS-02 Design Features

TRD/UPPER TOF
INTERFACES

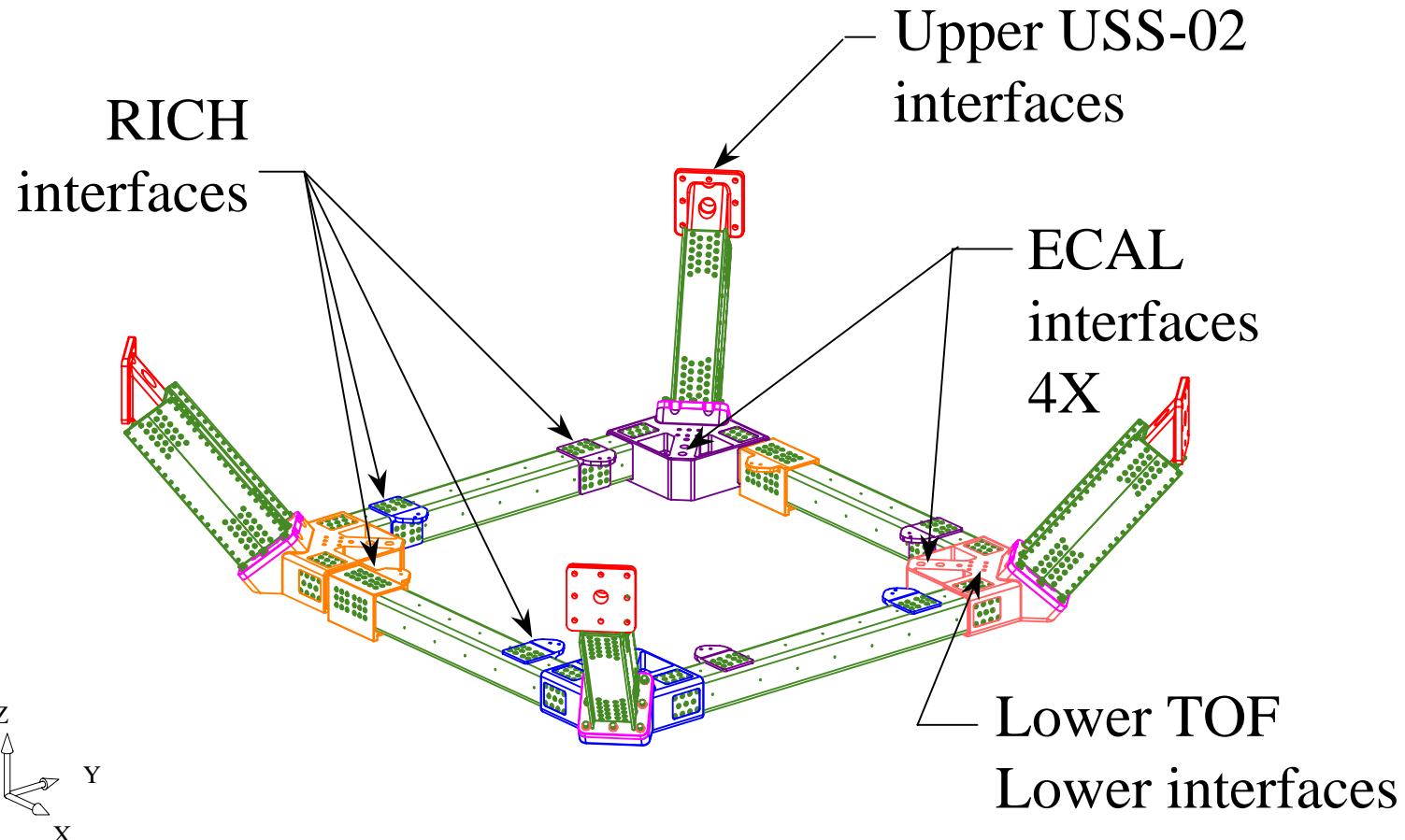
4X



LOWER TOF & LOWER
USS-02 INTERFACES
4X

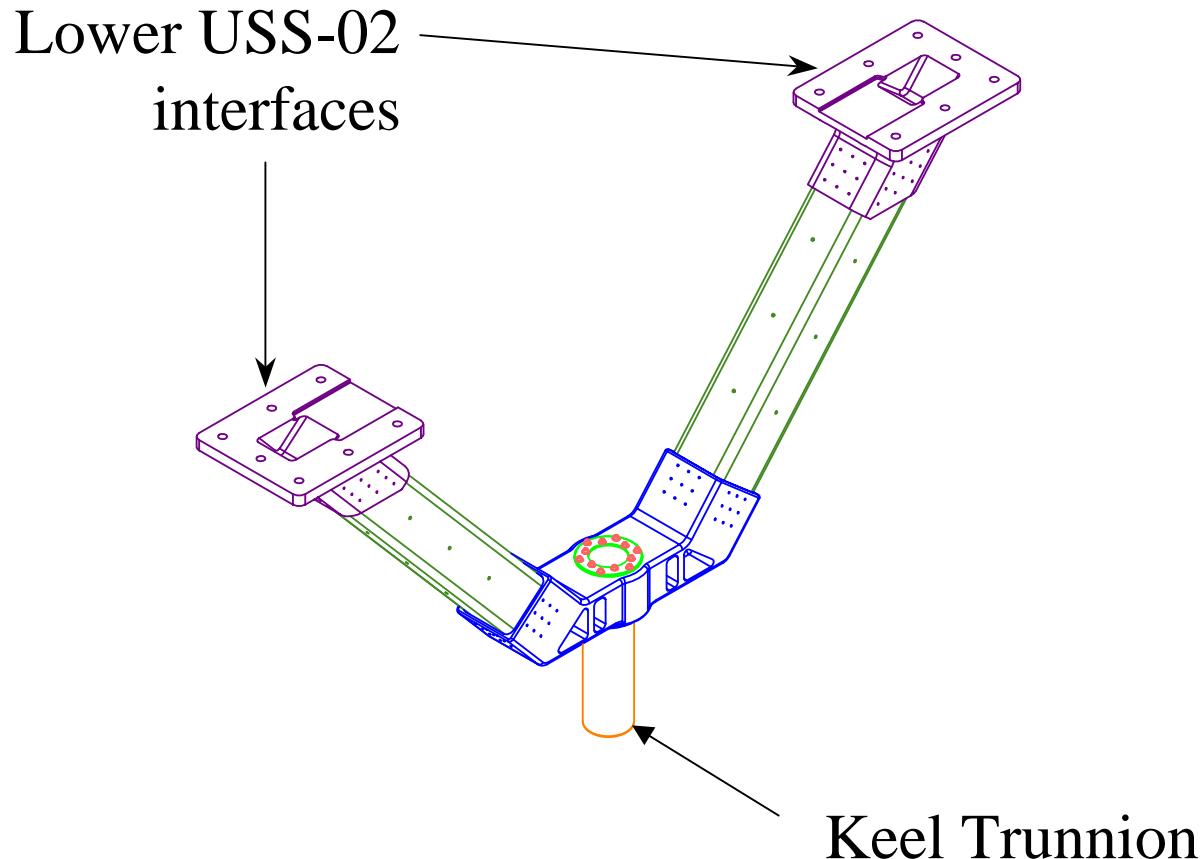
UPPER USS-02 ASSEMBLY

USS-02 Design Features



LOWER USS-02 ASSEMBLY

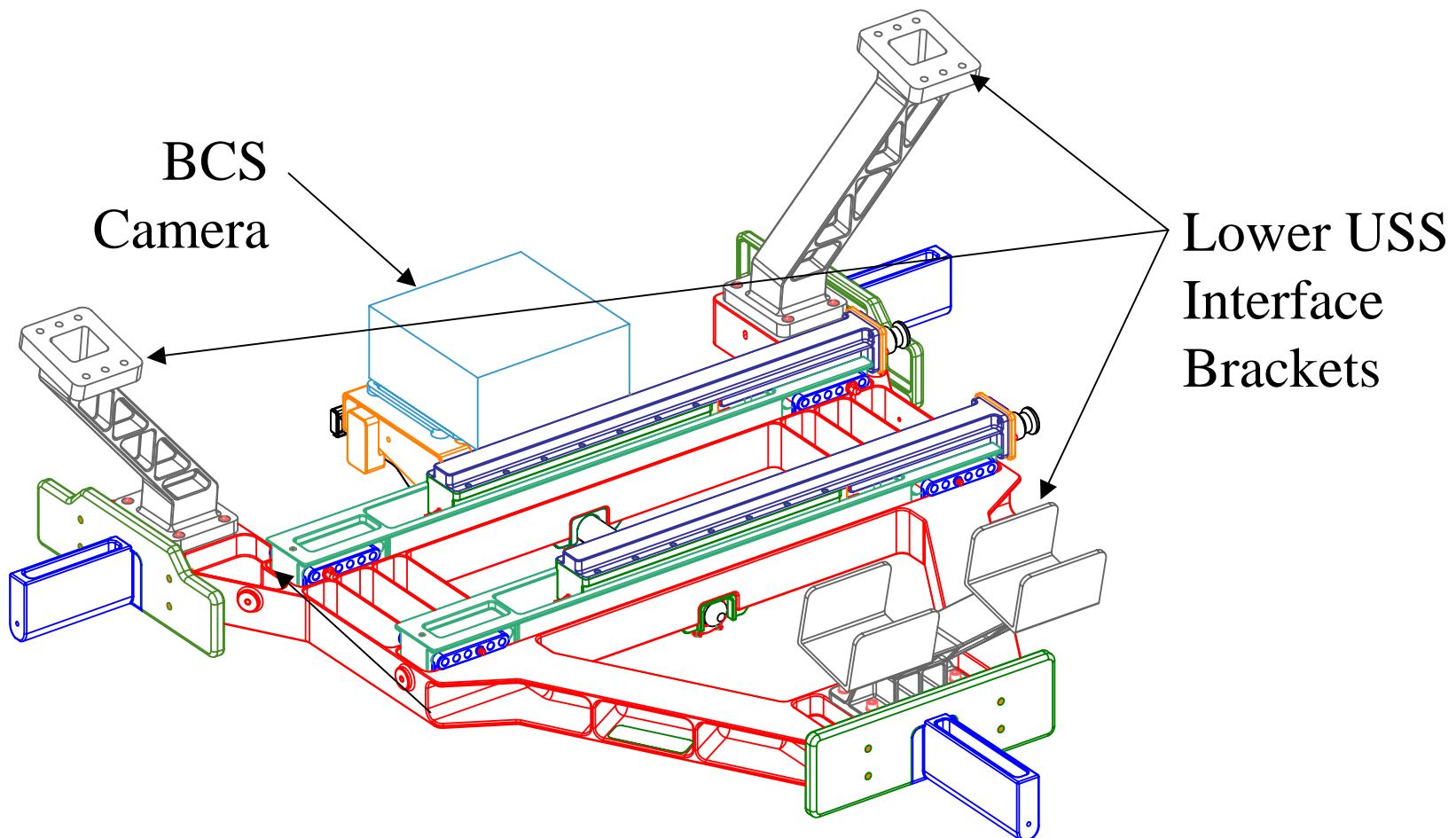
USS-02 Design Features



KEEL ASSEMBLY

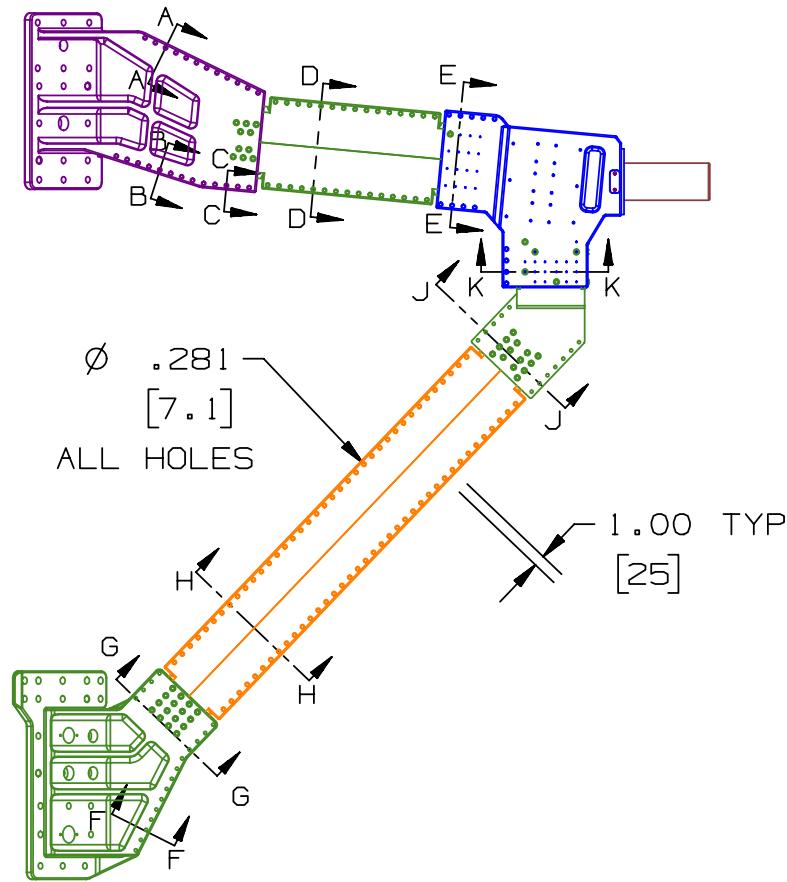


USS-02 Design Features



PAS Assembly - ISS Structural Interface

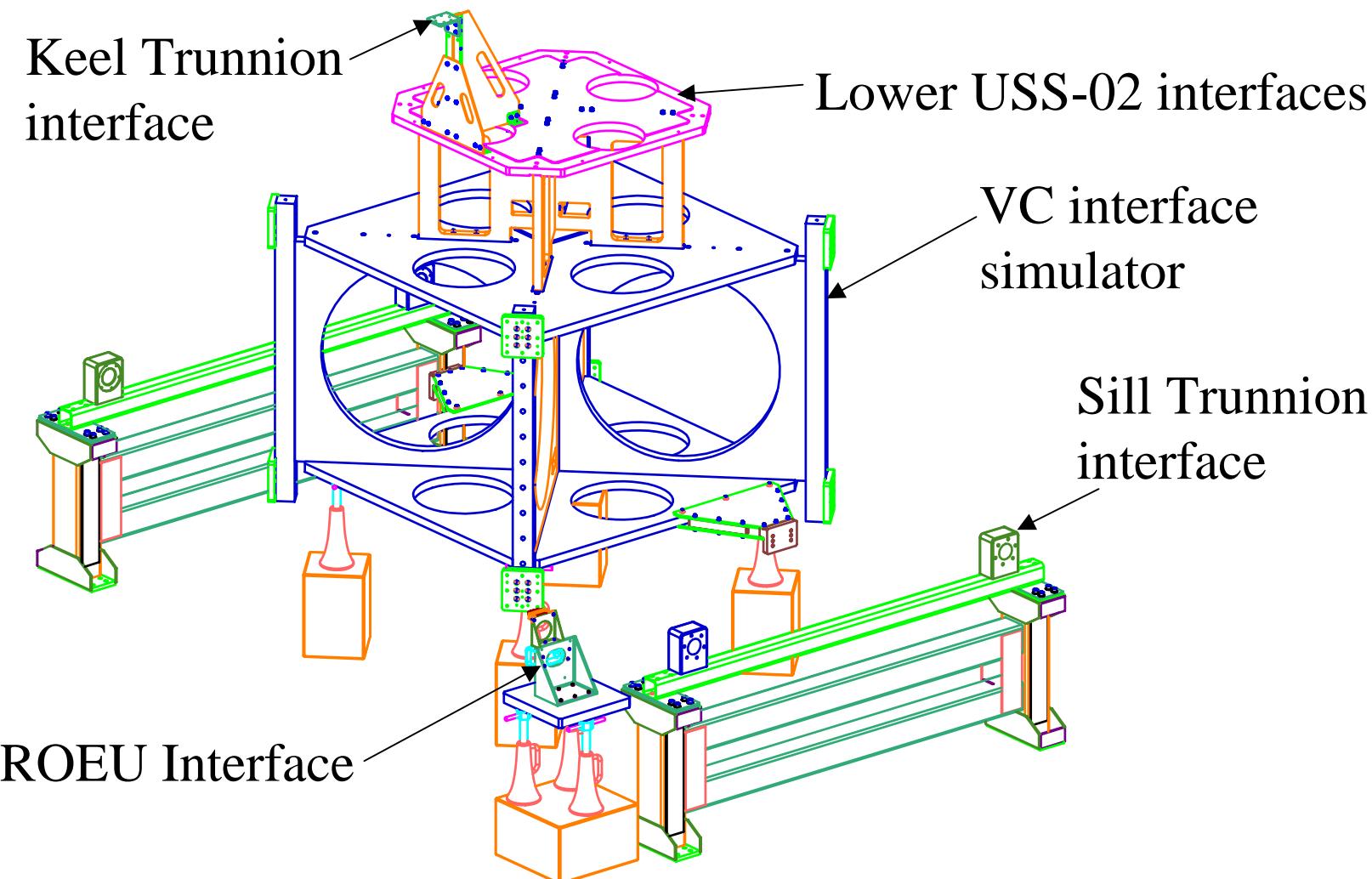
USS-02 Design Features



USS-02 Generic Hole Pattern - provides
experiment integration flexibility



USS-02 Design Features

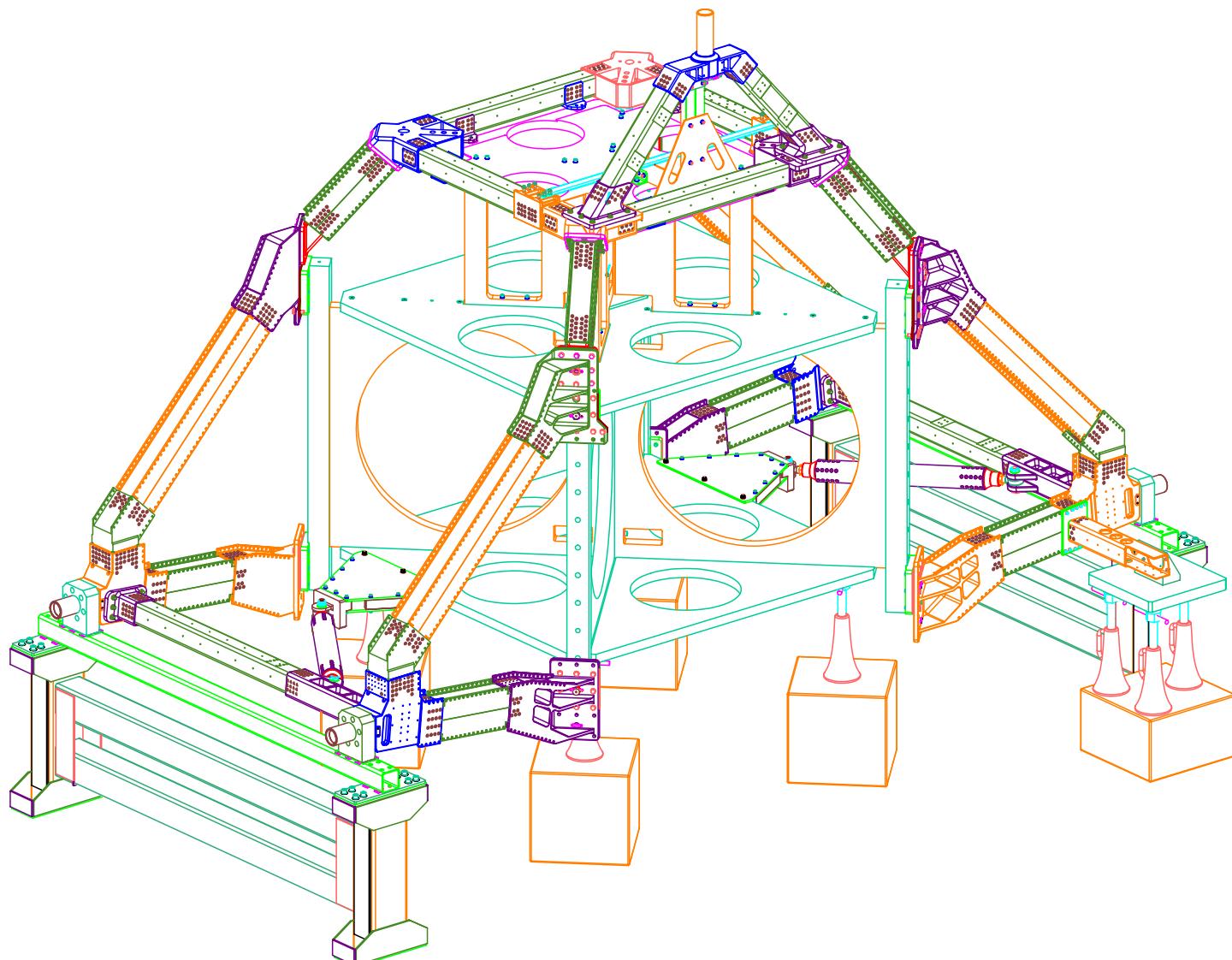


USS-02 Assembly Fixture - precision interface alignment fixture
using laser tracker



USS-02

LOCKHEED MARTIN

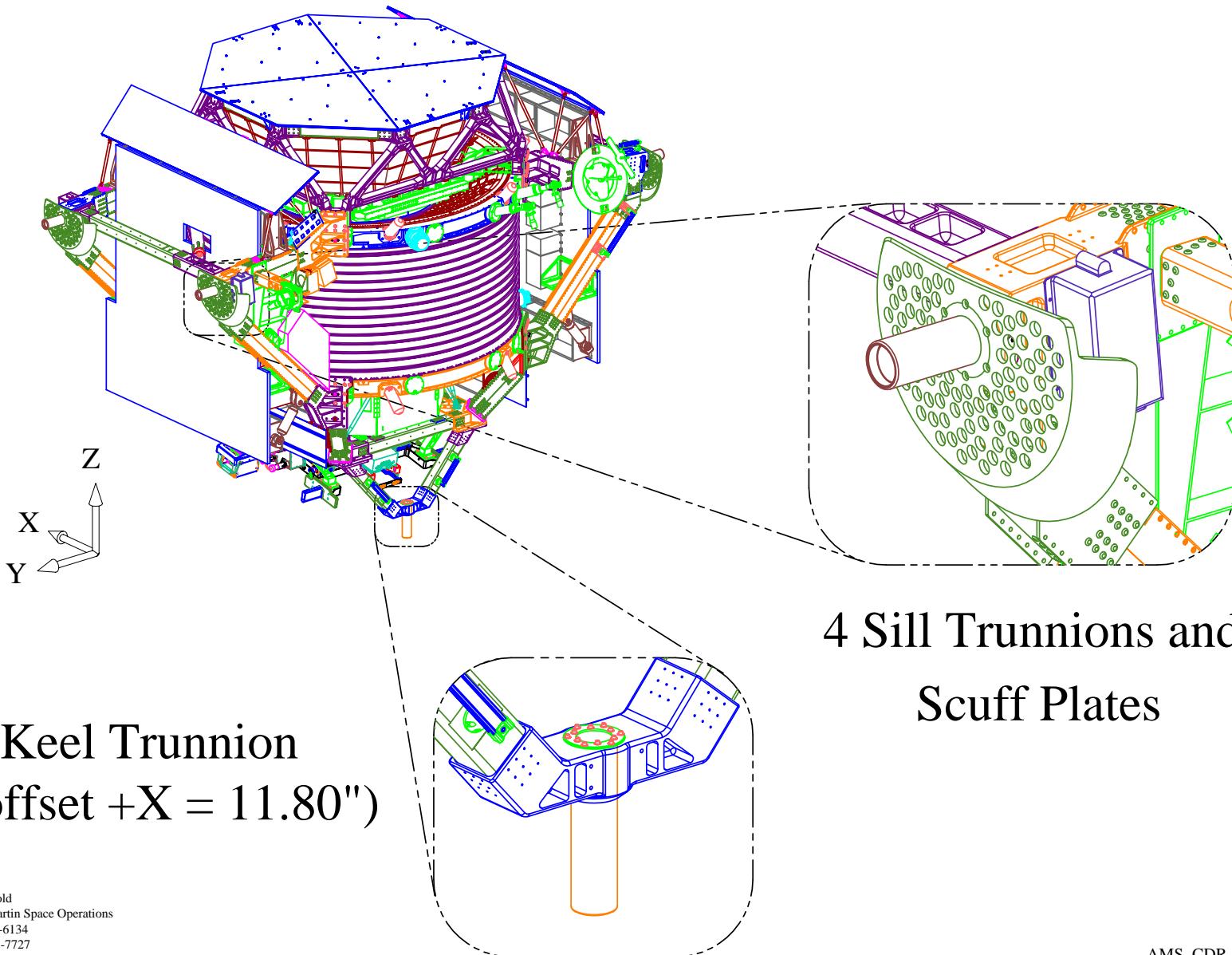


USS-02 assembly complete

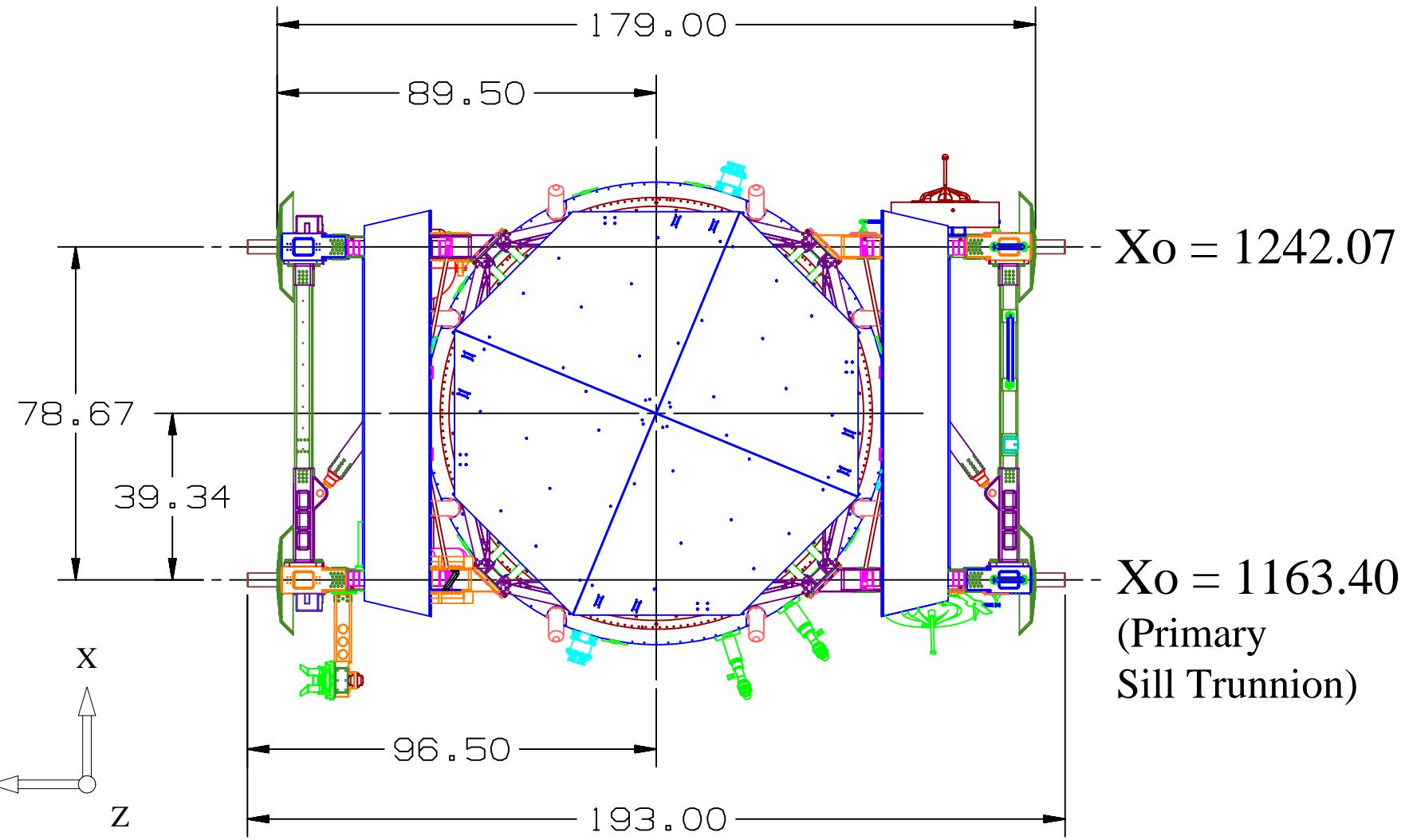


Shuttle Integration Hardware

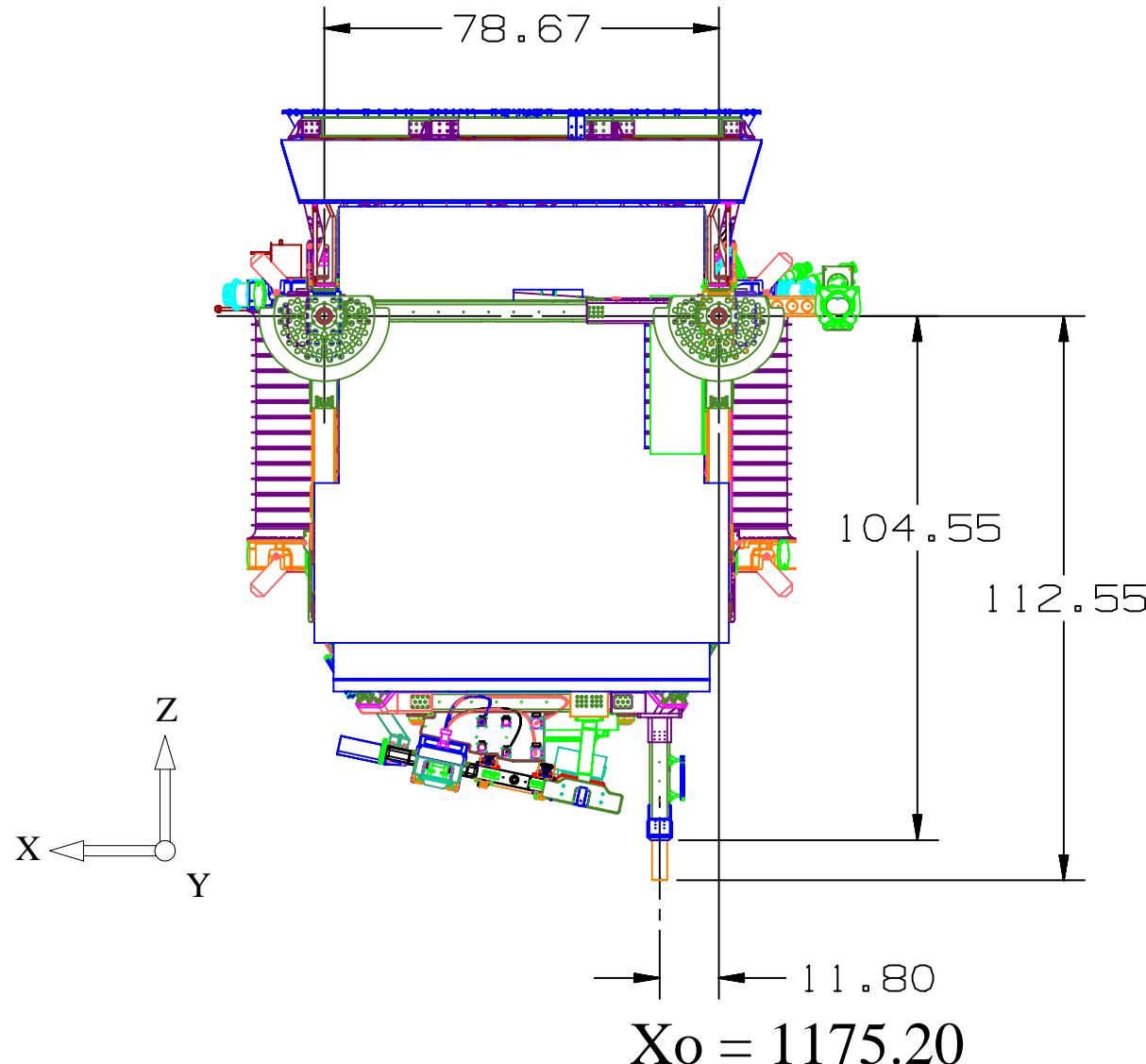
Trunnions and Scuff Plates



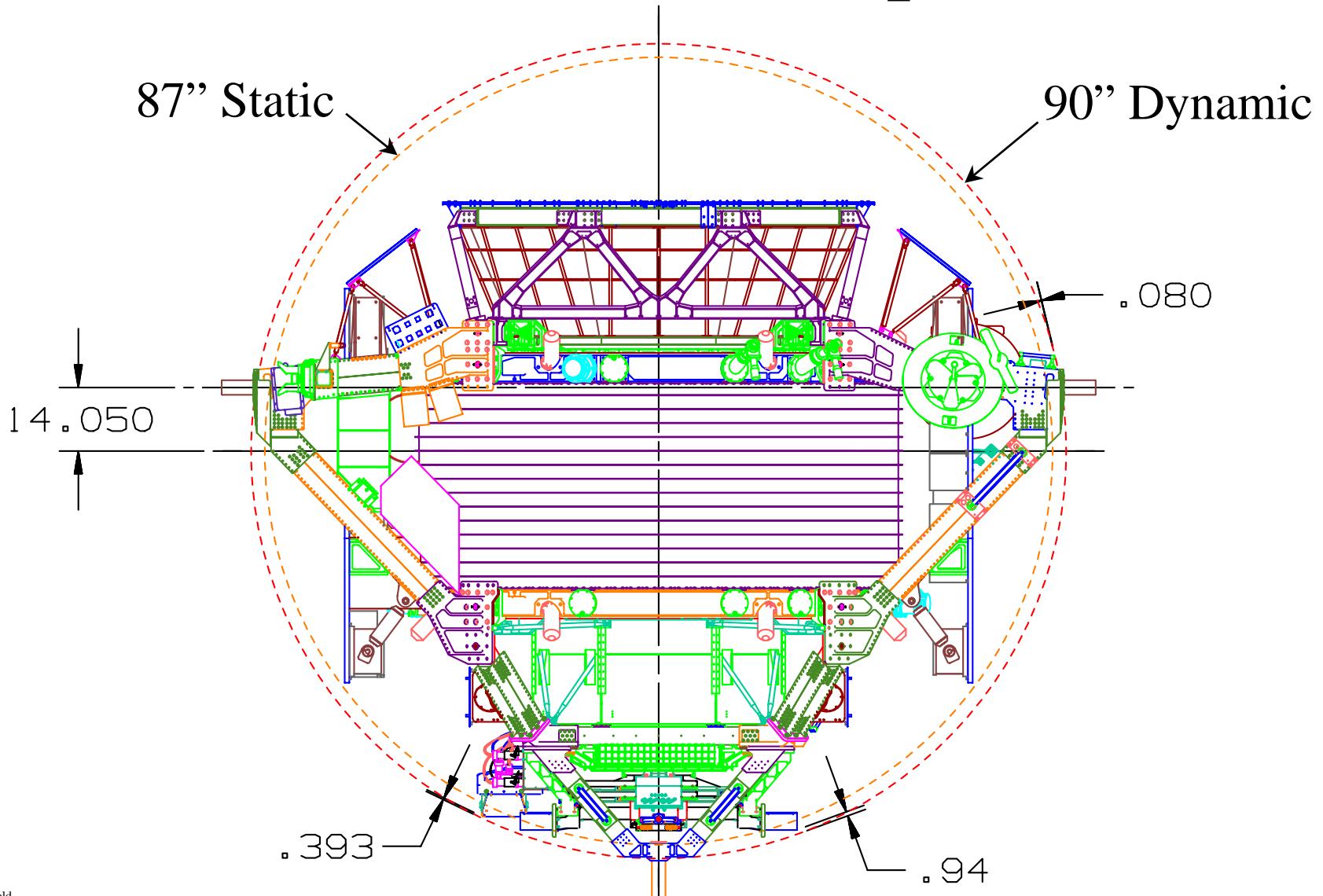
Trunnions and Scuff Plates



Trunnions and Scuff Plates



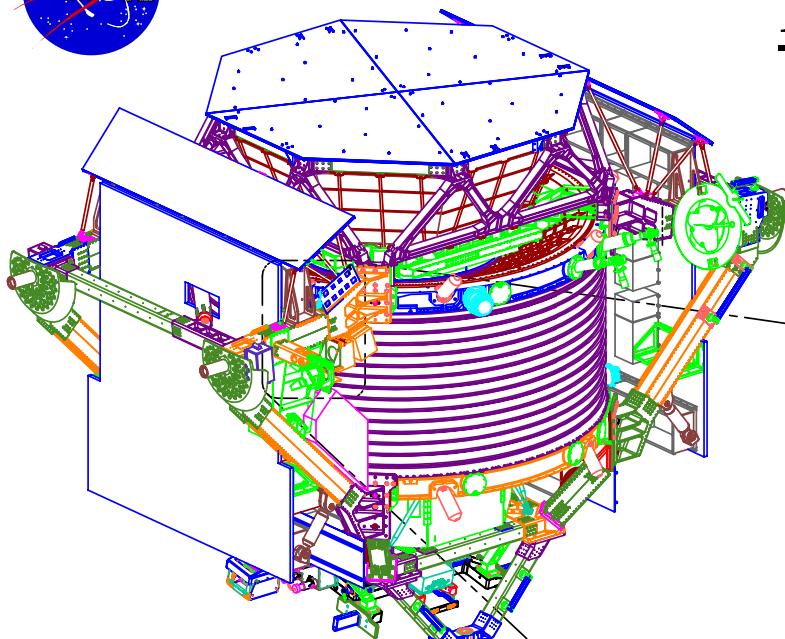
Orbiter Envelopes





ROEU

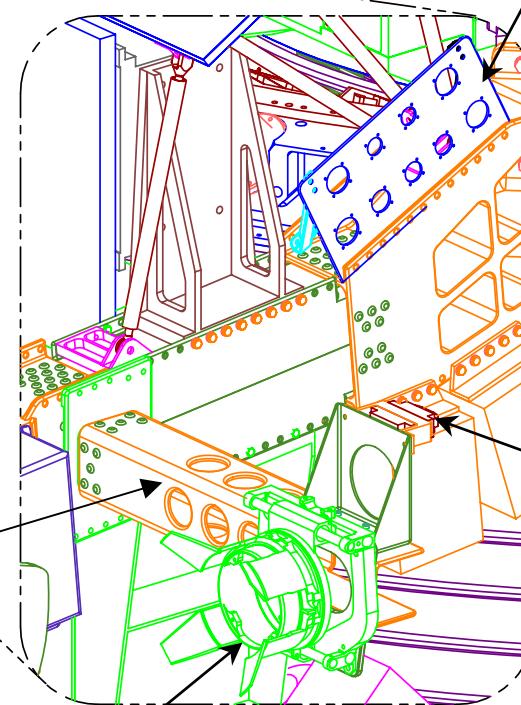
LOCKHEED MARTIN



X
Y
Z

ROEU Bracket
Assembly

ROEU Connector
Panel / Panel A



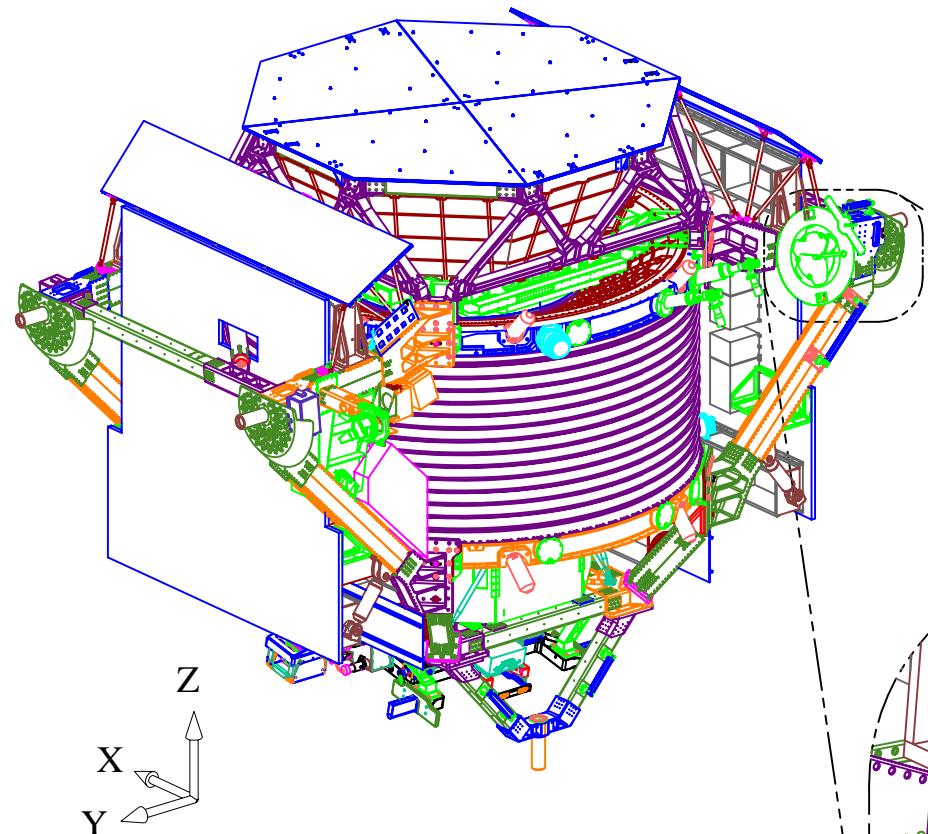
PDA
Harness
Connector

PDA

$X_o = 1104.40$

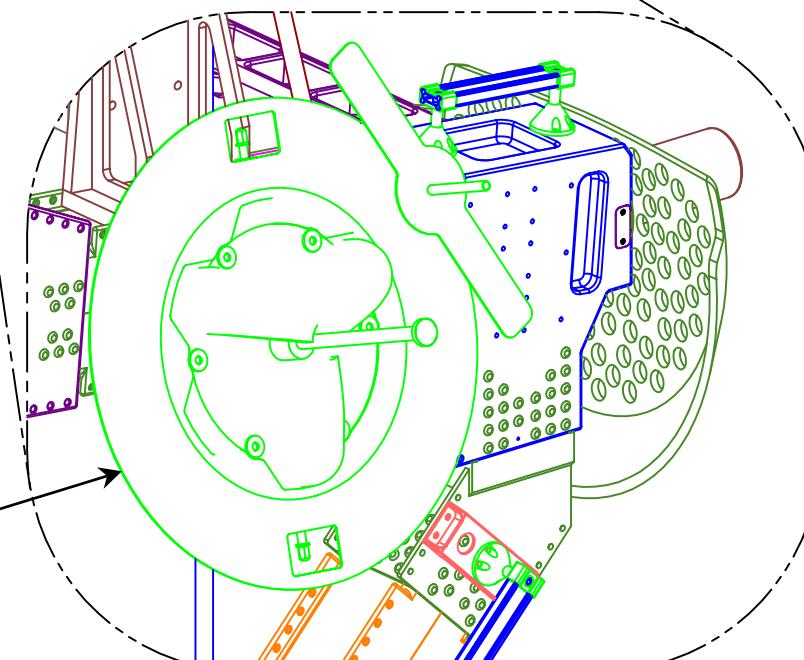


FRGF



Maximum offset from
the grapple fixture origin
to AMS-02 Payload CG
is 87.4"

FRGF

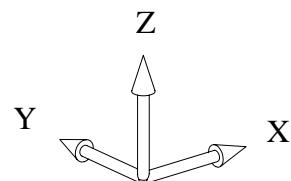
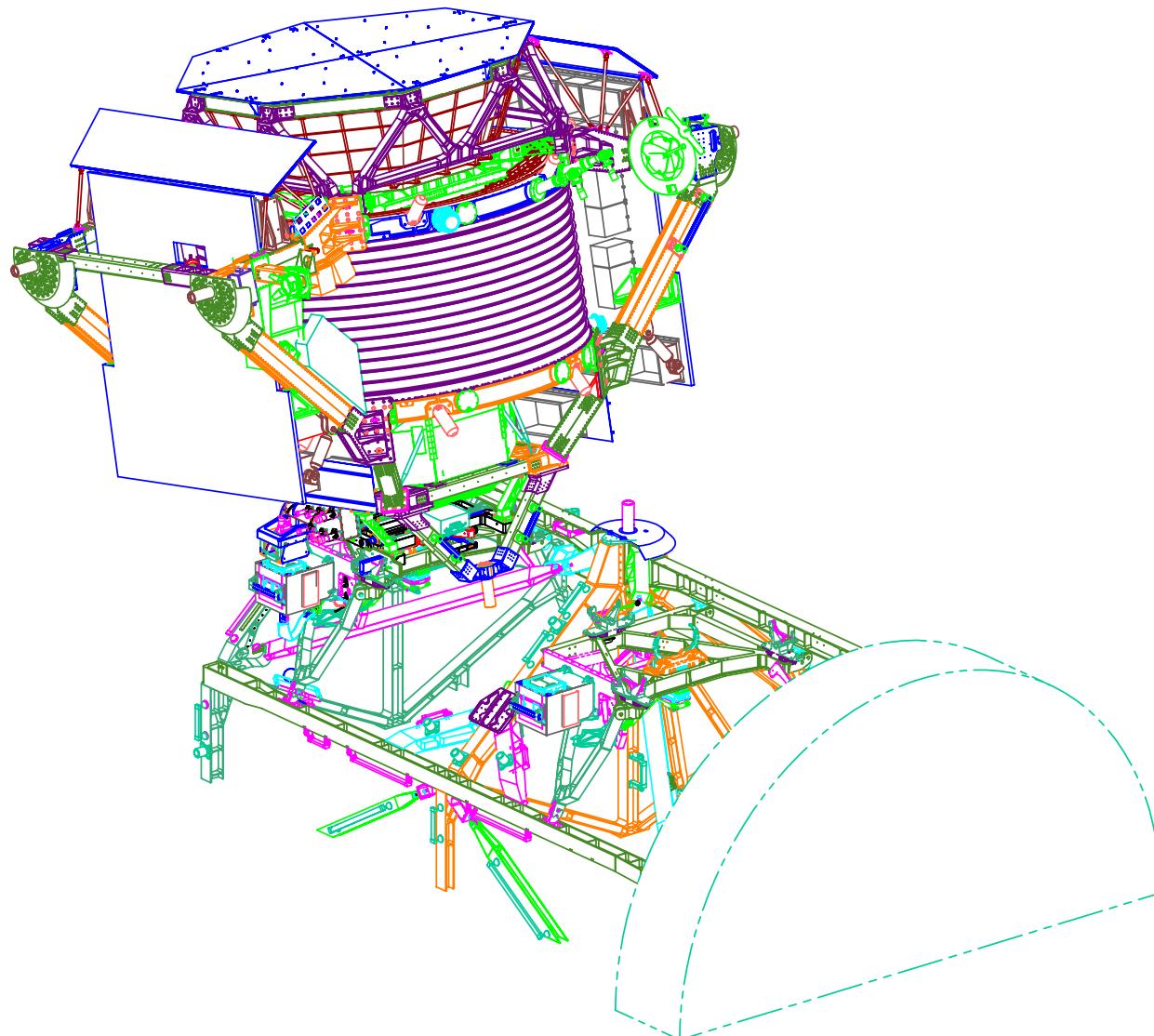




ISS Integration Hardware

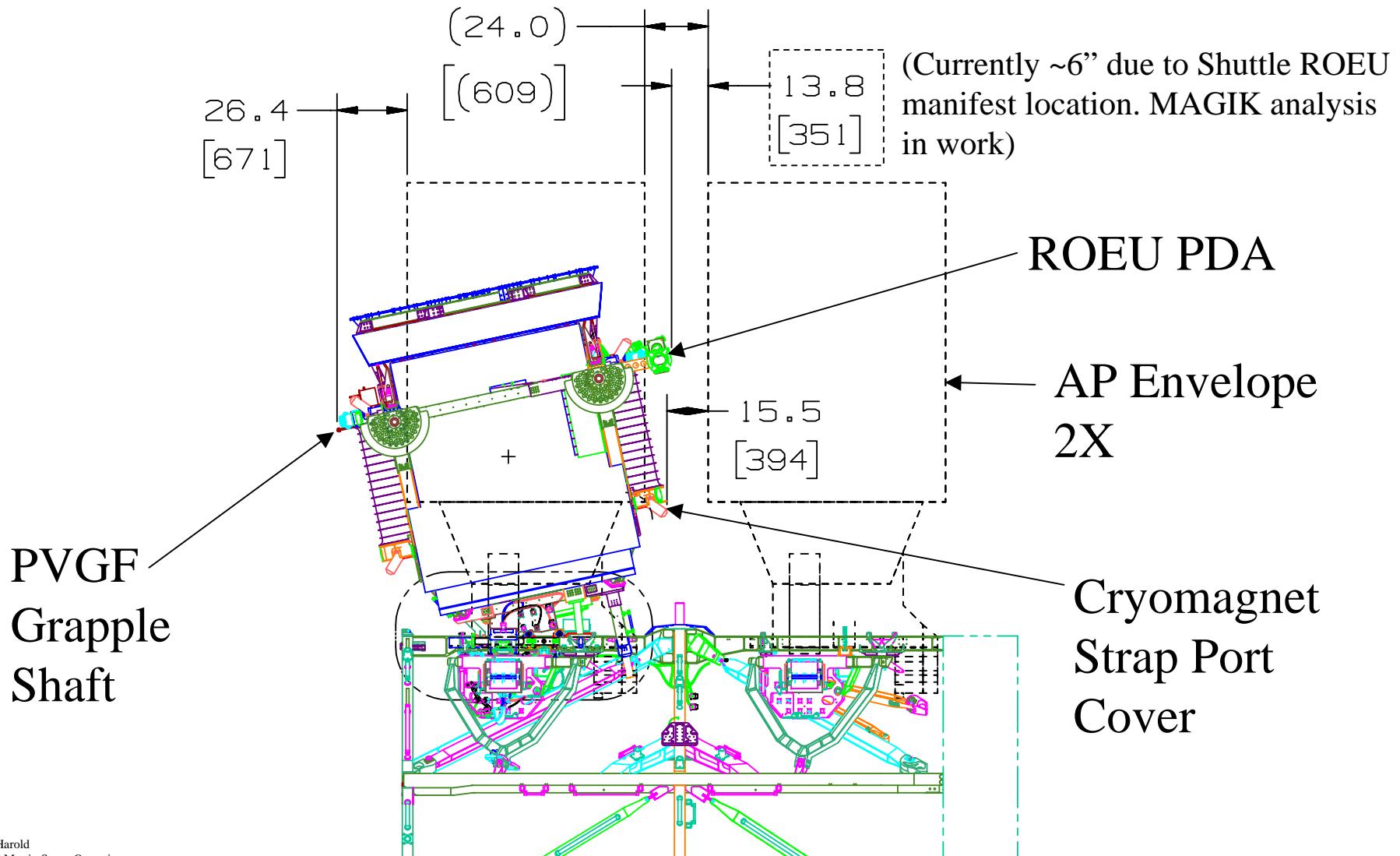


AMS-02 Payload Assembly attached to ITS S3 PAS site No. 2



Active PAS No. 2
coordinate system
directions

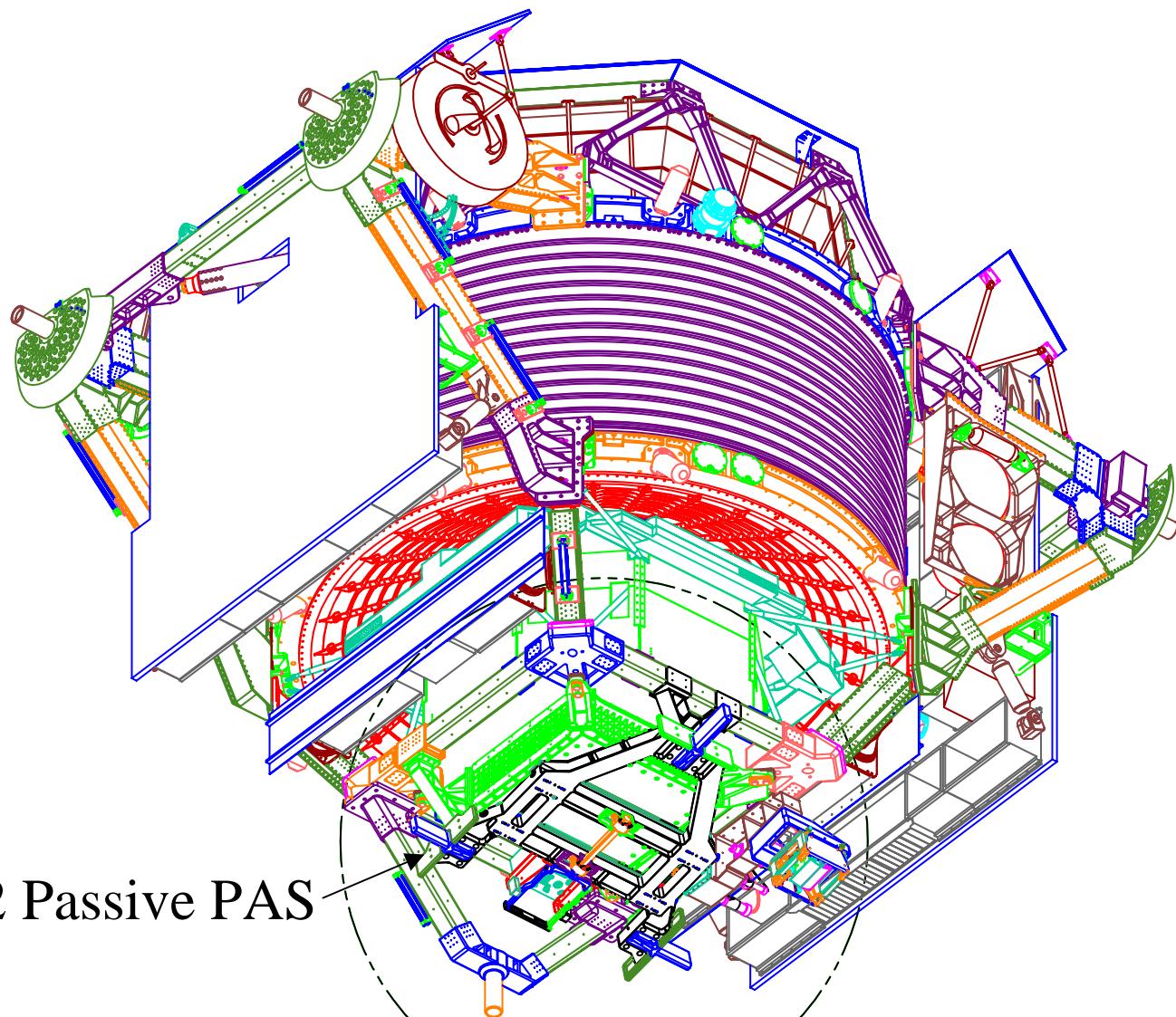
AMS-02 Payload Assembly with ISS AP Envelopes (looking in RAM direction)





Passive PAS

LOCKHEED MARTIN



AMS-02 Passive PAS



Passive PAS

Capture Bar

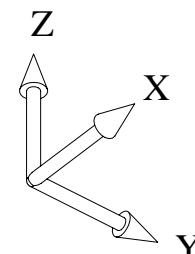
Guide Pin

Scuff Plate

Umbilical
Mechanism
Assembly
(UMA)

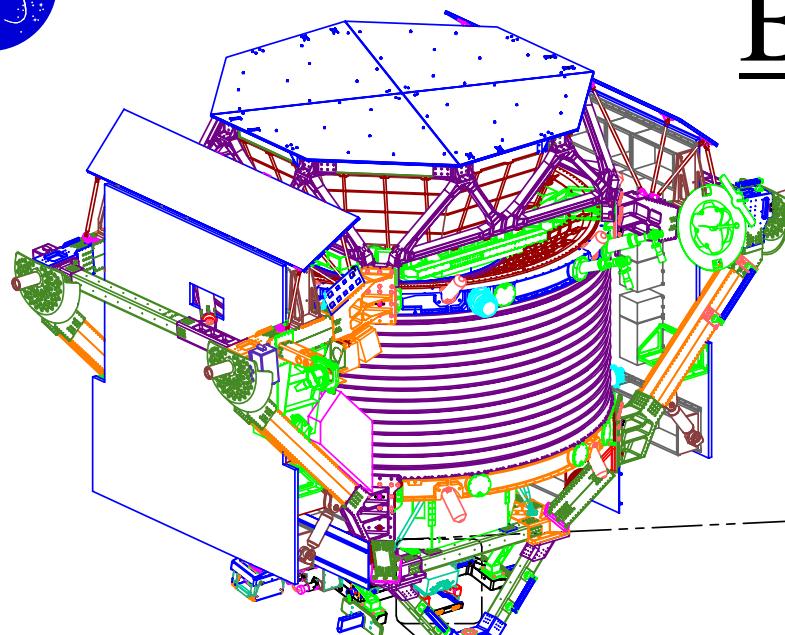
Capture Bar
EVA Handle

PAS Platform



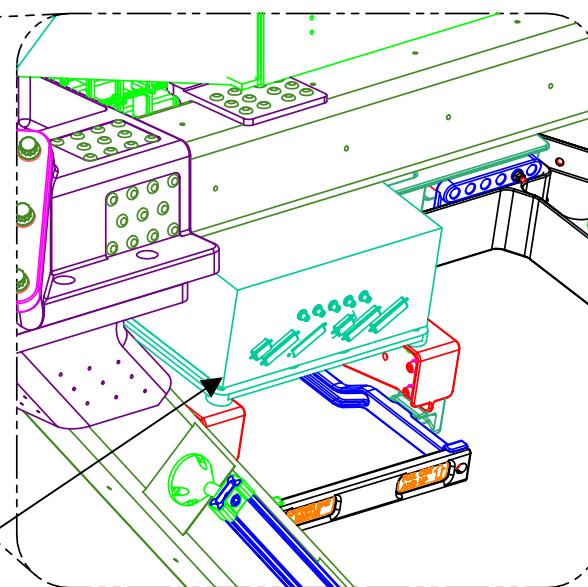


BCS

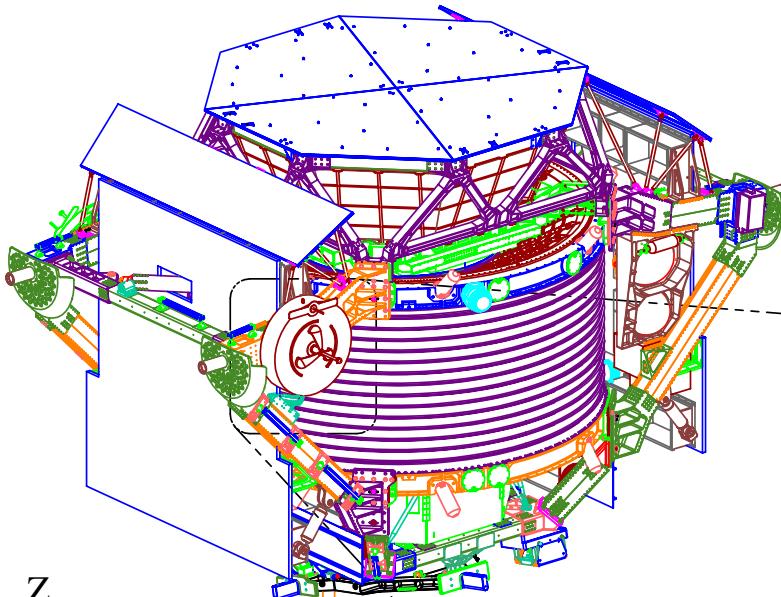


Z
X
Y

BCS Camera
(mounted to PAS)

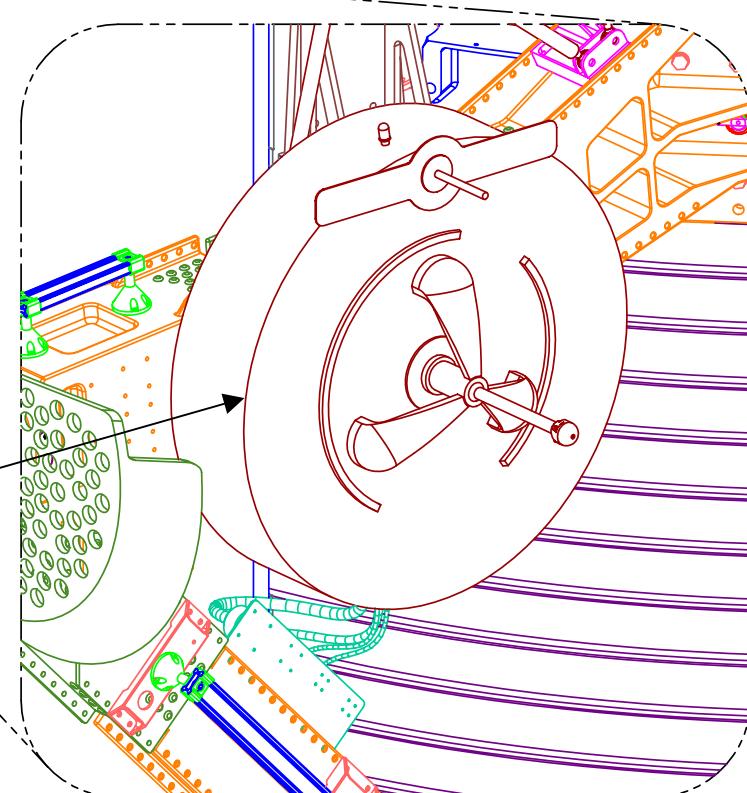


PVGF



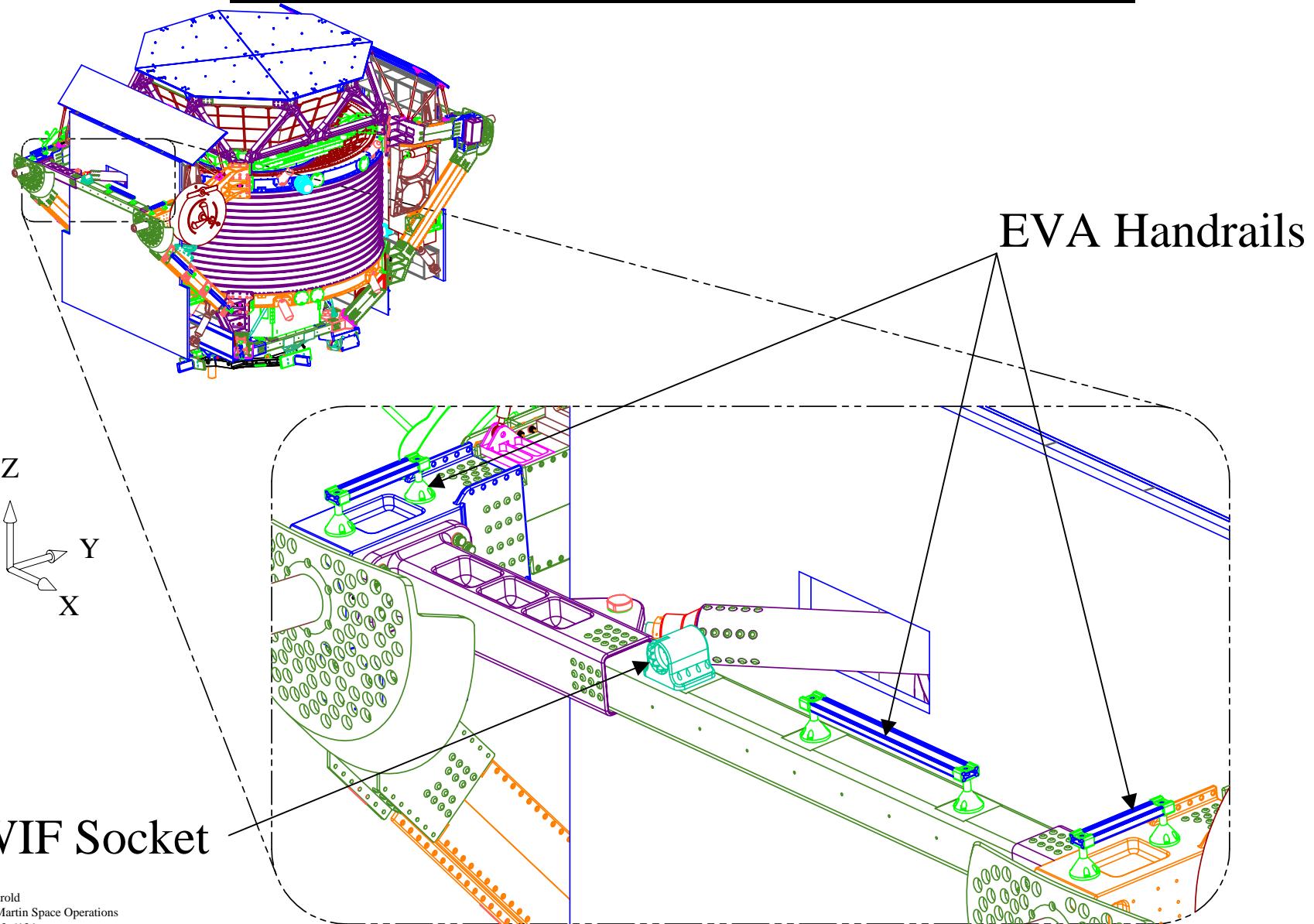
Power Video
Grapple Fixture
(PVGF)

Maximum offset from
the grapple fixture origin
to AMS-02 Payload CG
is 91.8"



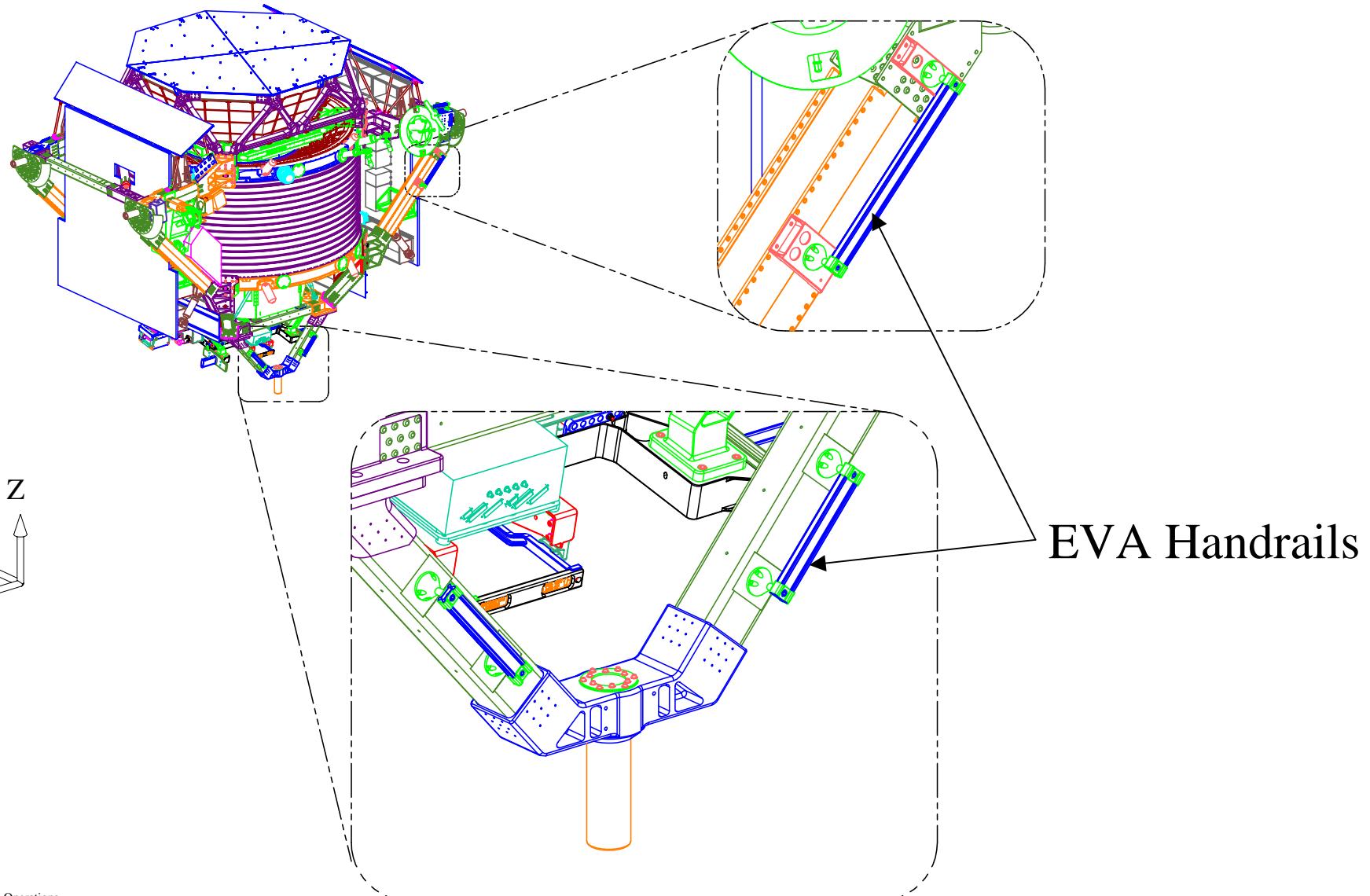


EVA Handrails and WIF



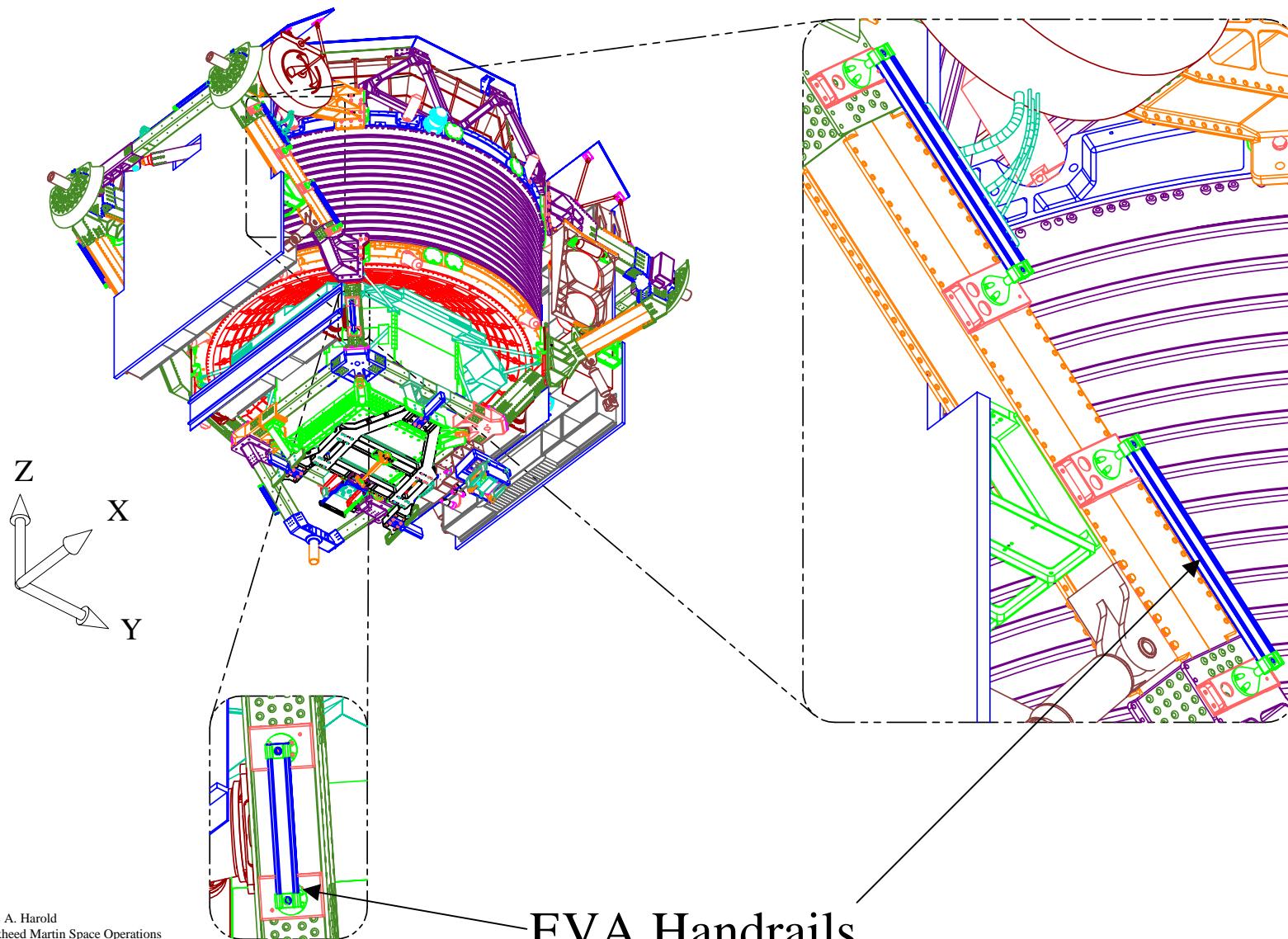


EVA Handrails and WIF





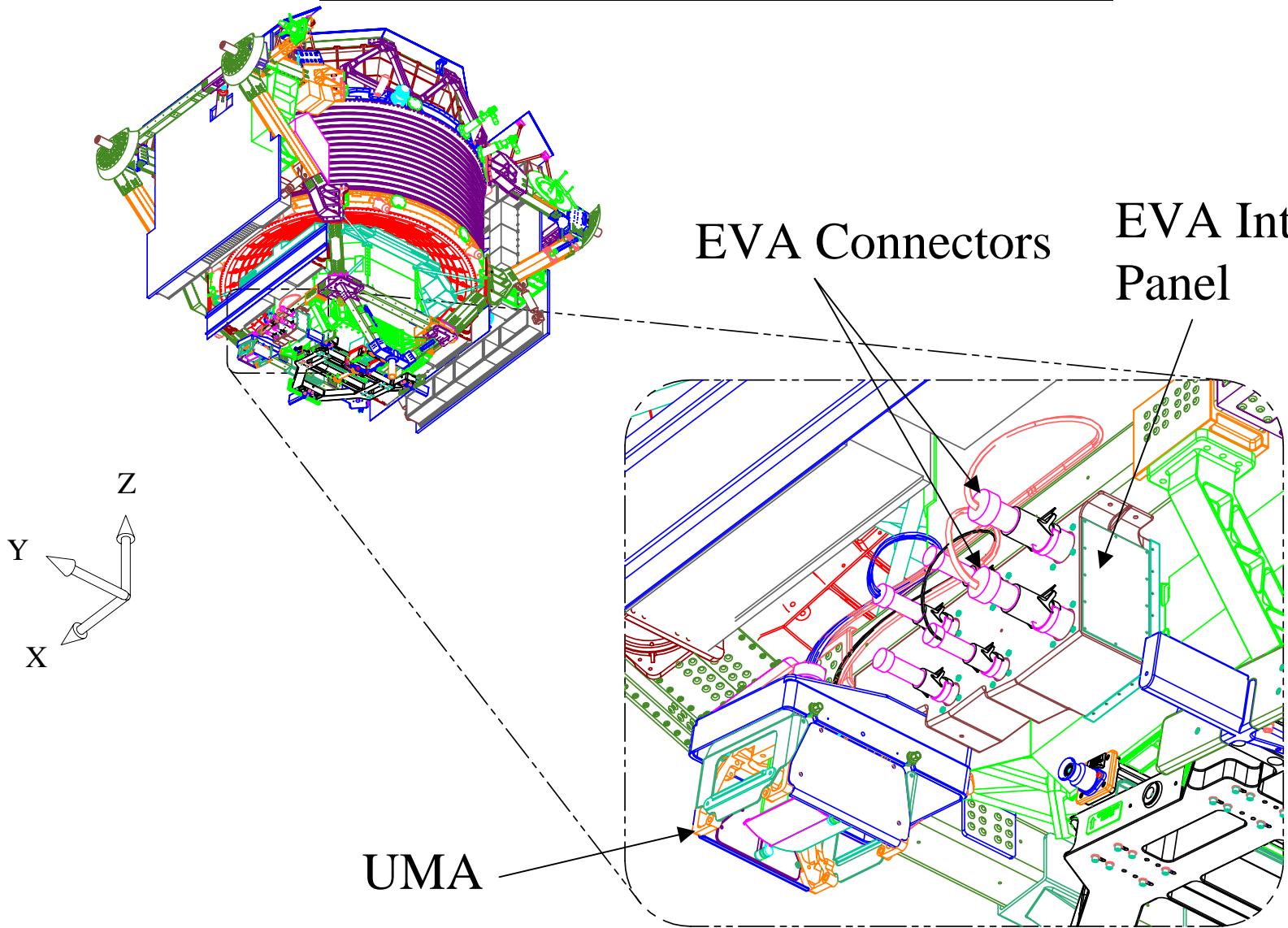
EVA Handrails and WIF



EVA Handrails



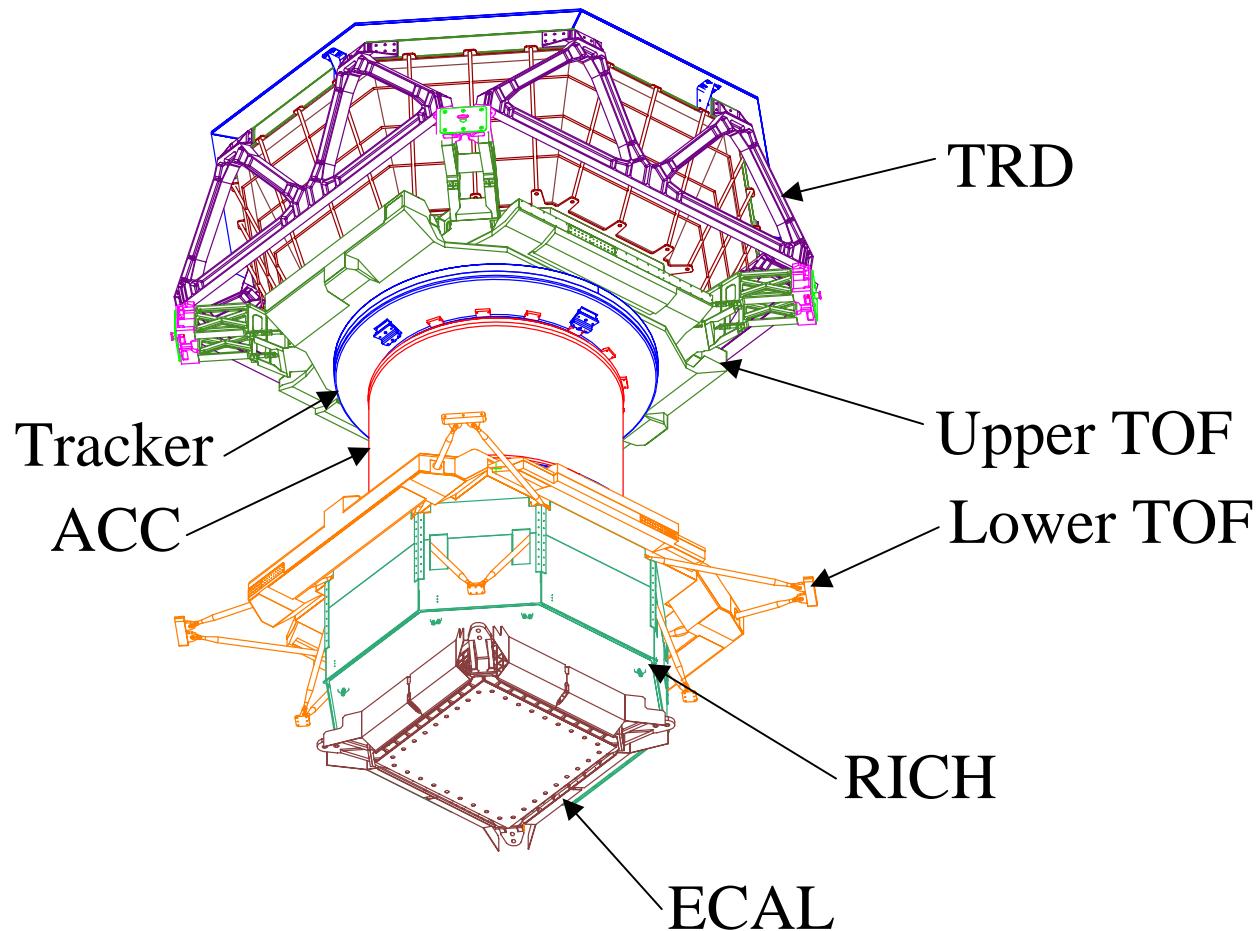
EVA Interface Panel



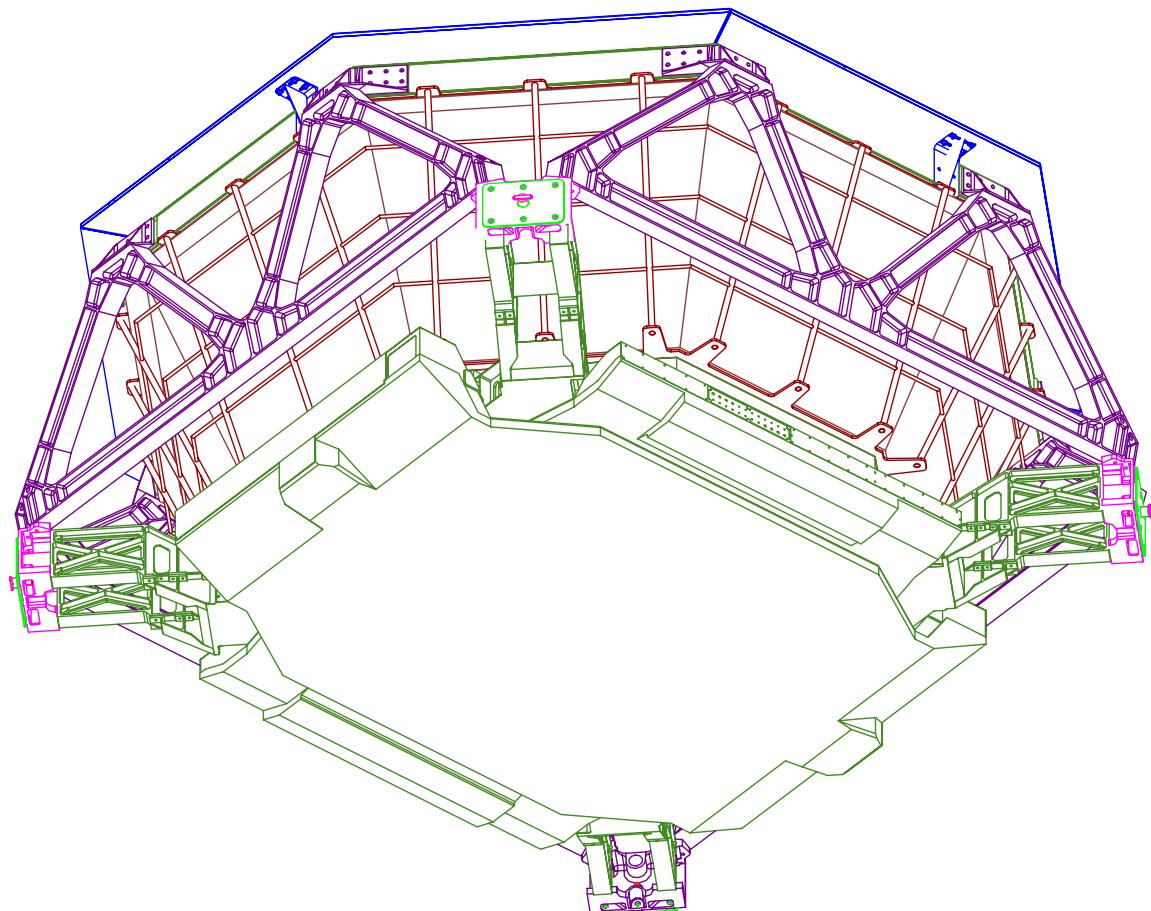


Experiment Interfaces

AMS-02 Experiment Detectors

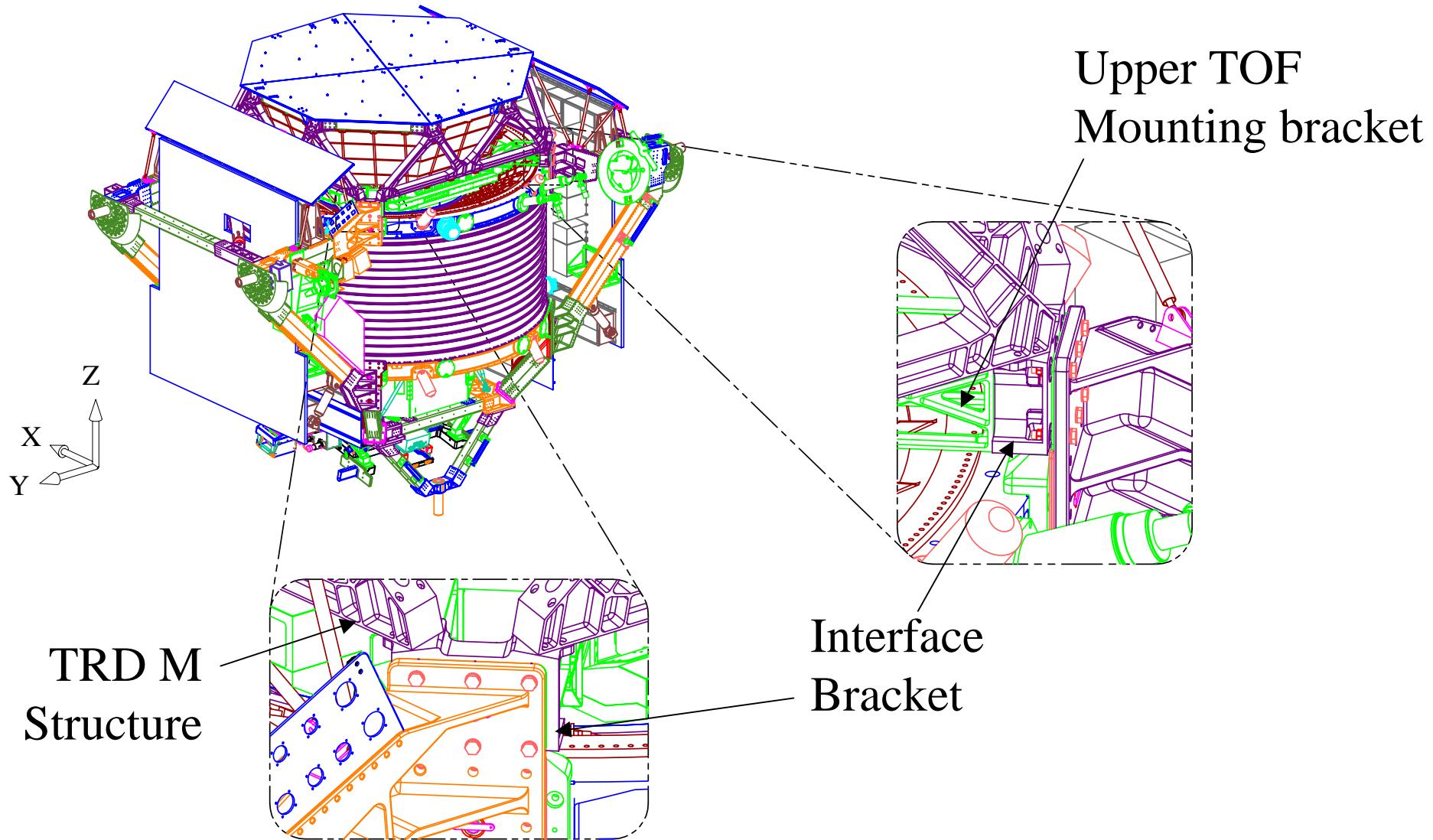


TRD and Upper TOF



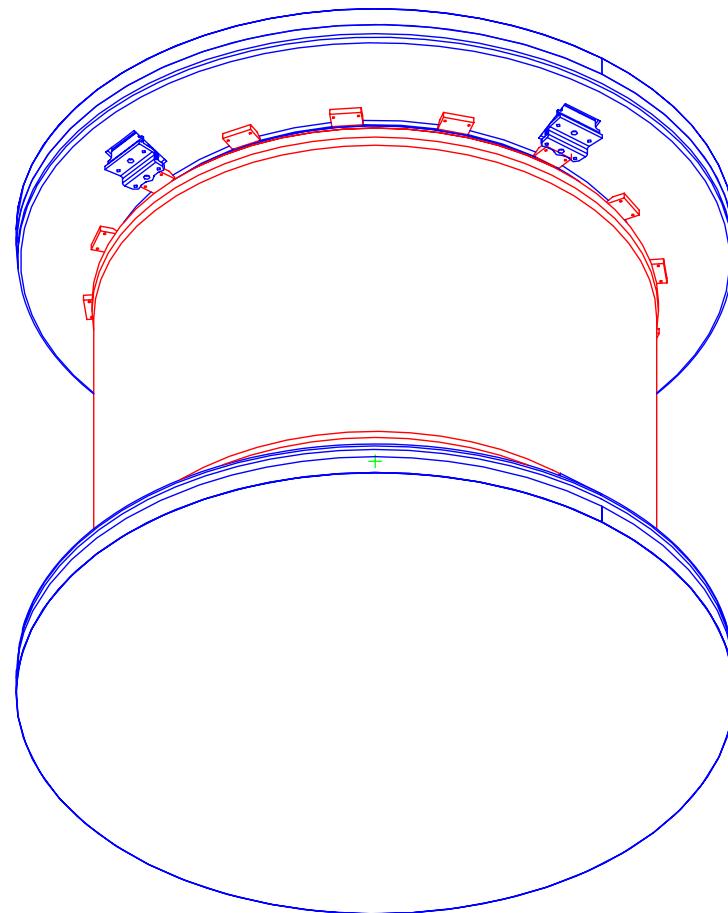


TRD and Upper TOF

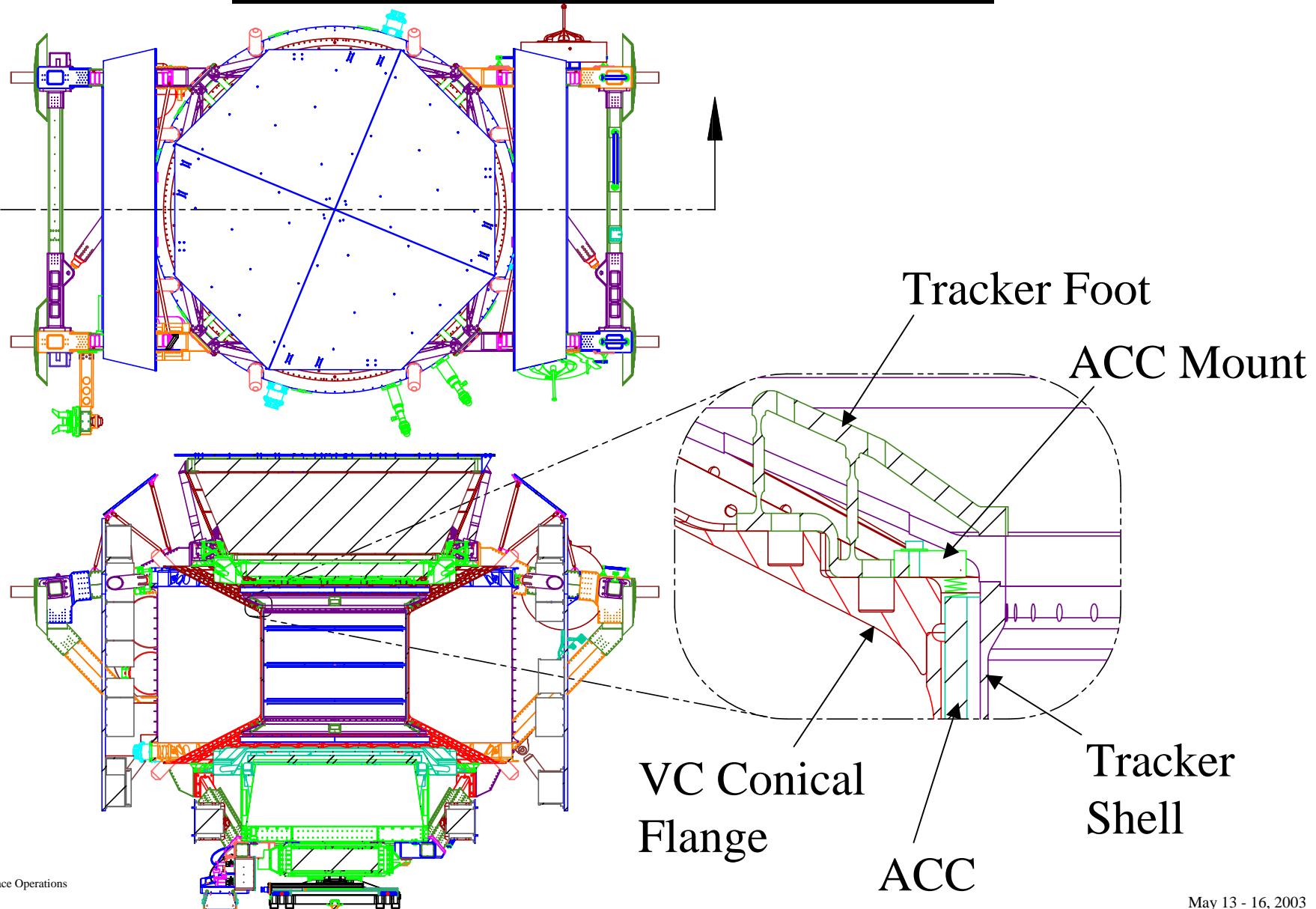




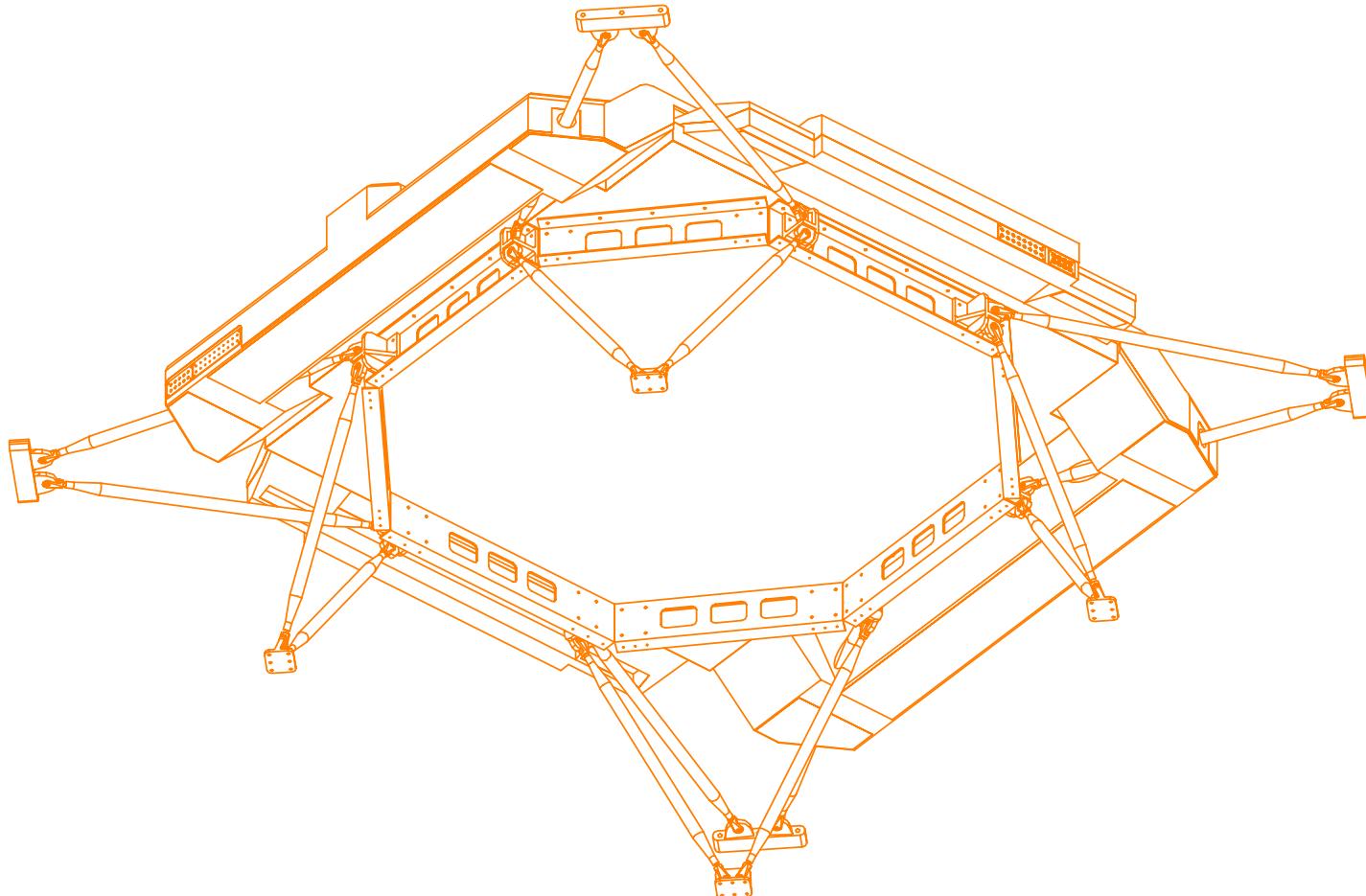
TRACKER and ACC



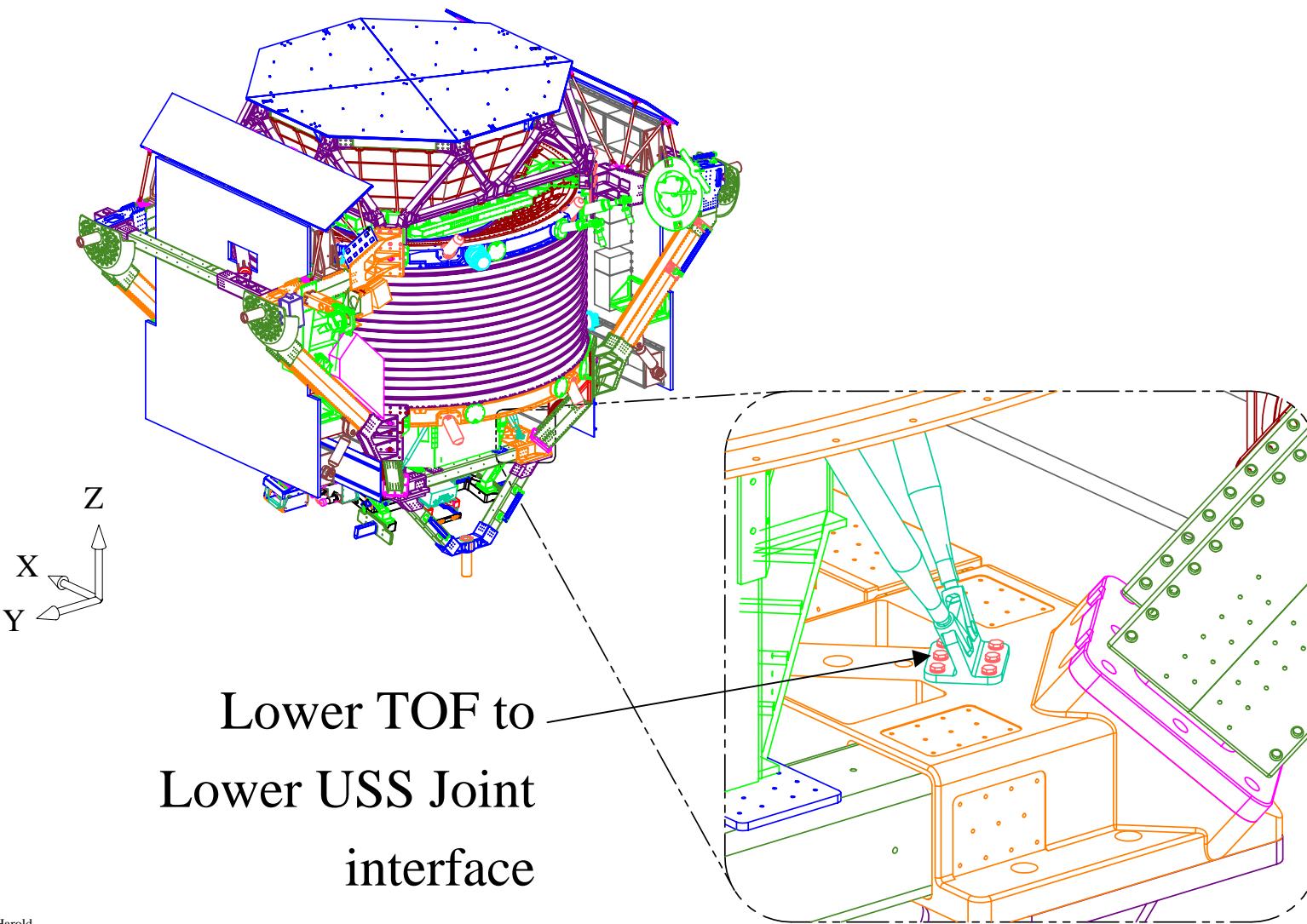
TRACKER and ACC



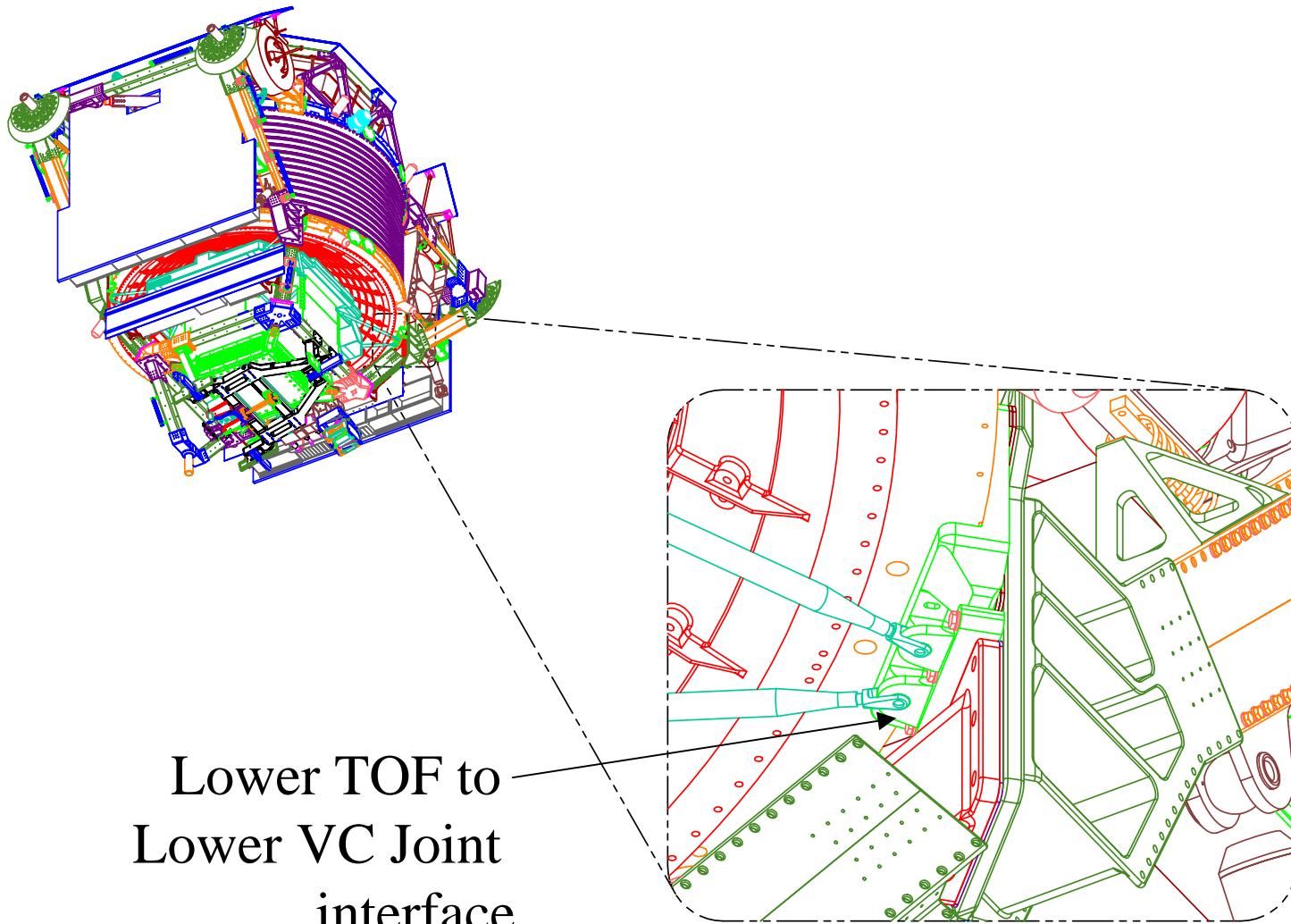
Lower TOF



Lower TOF

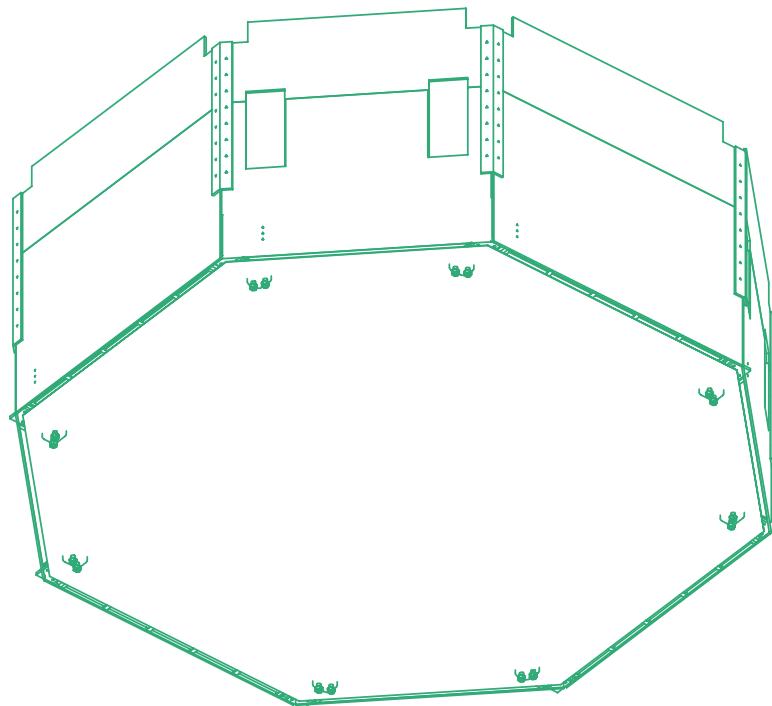


Lower TOF



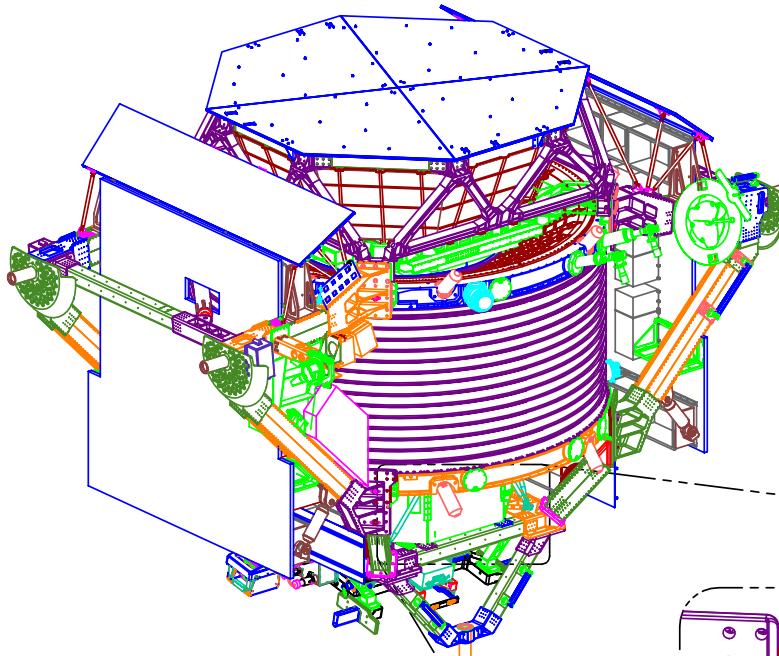


RICH

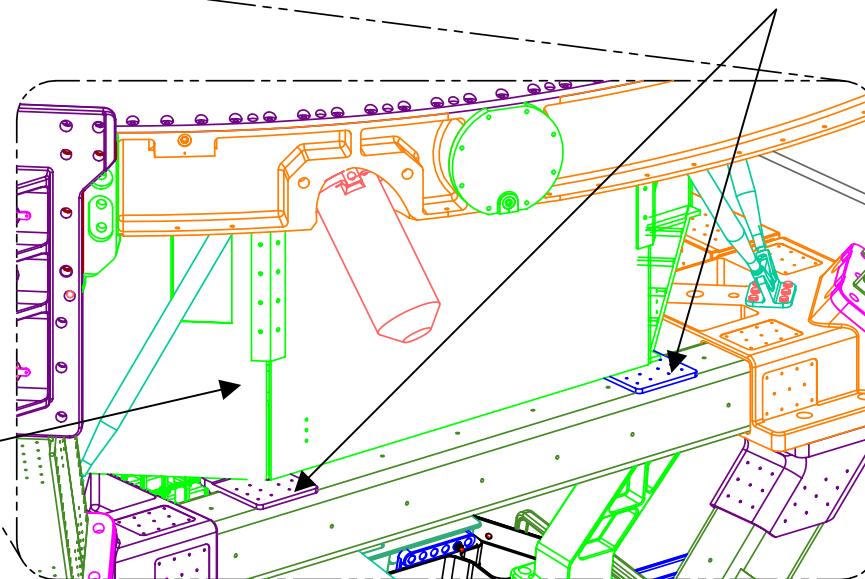




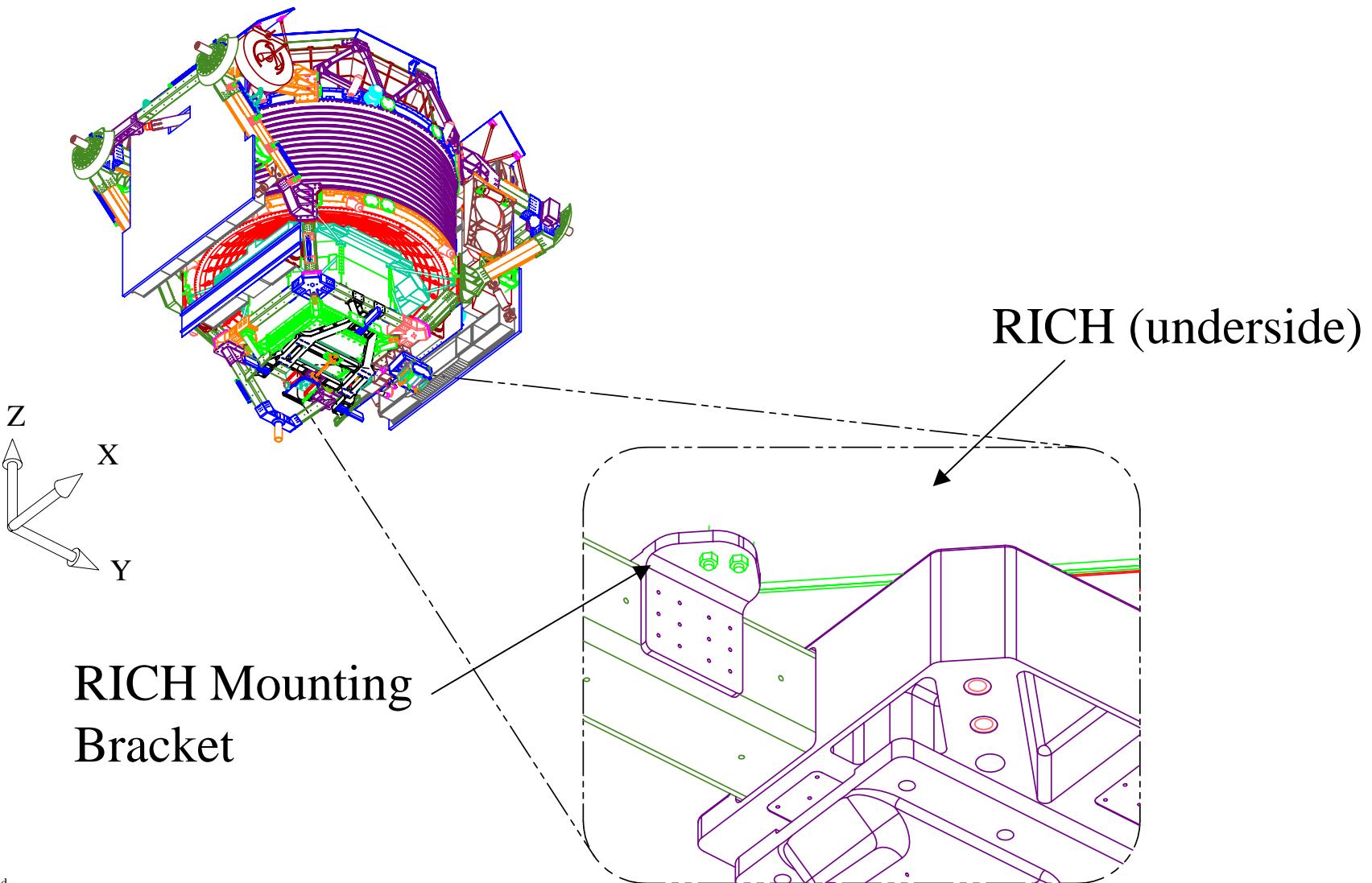
RICH



RICH Mounting
Brackets

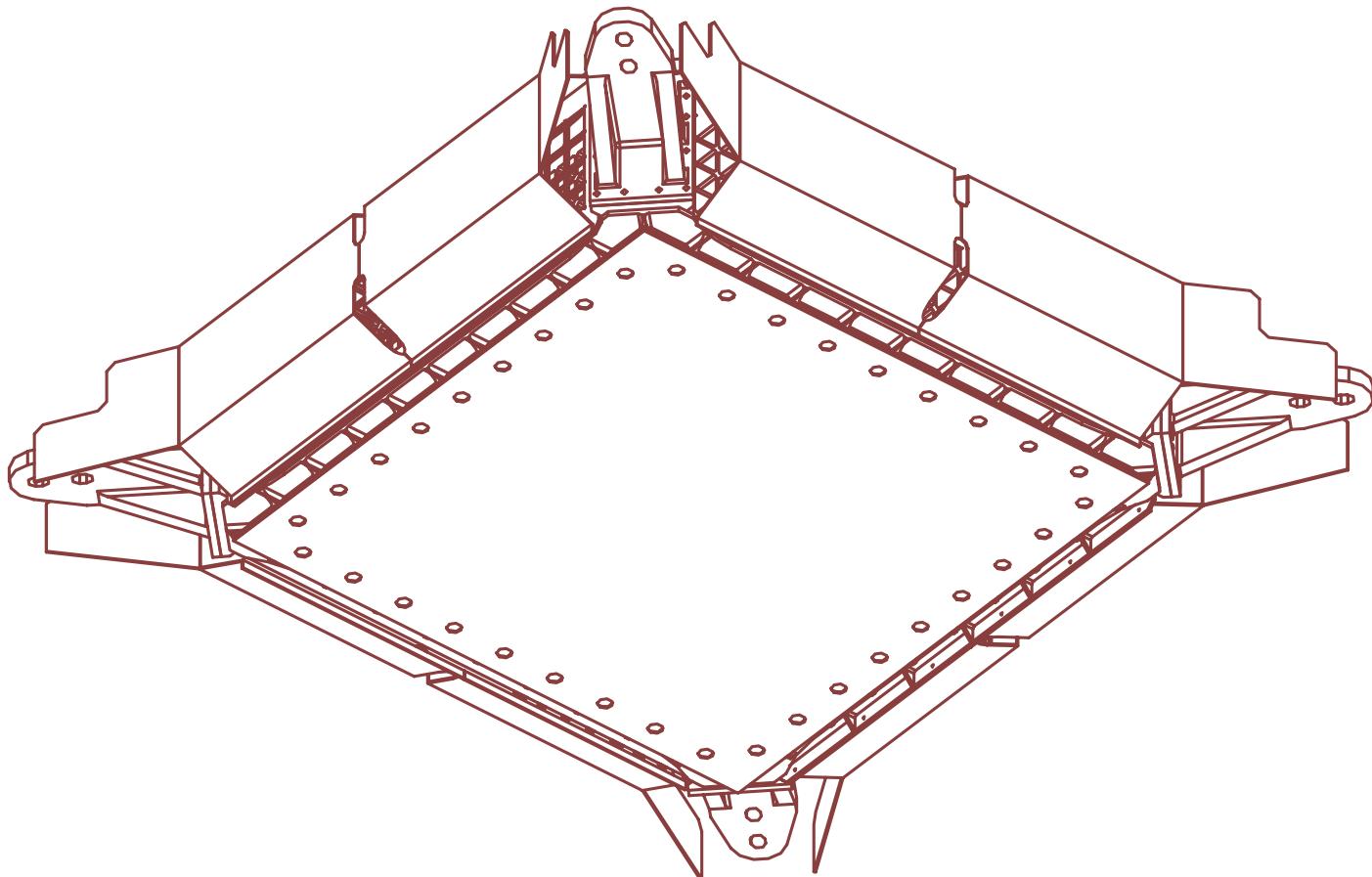


RICH



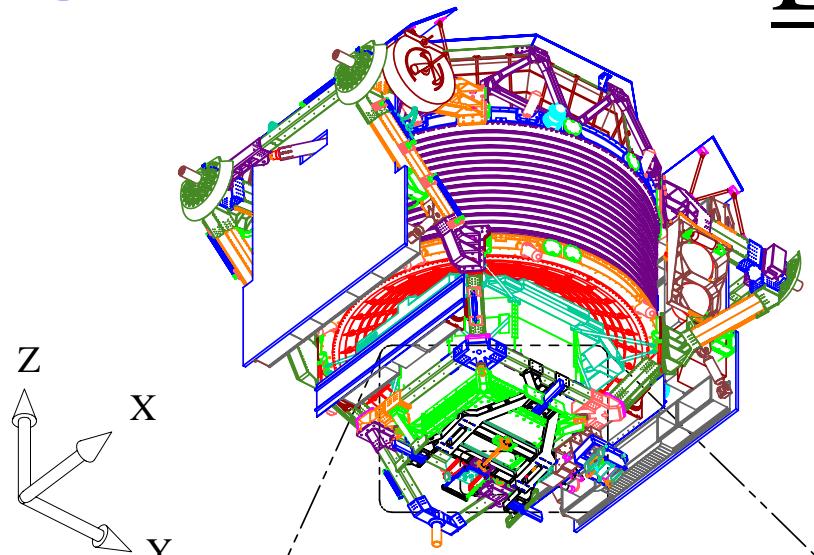


ECAL

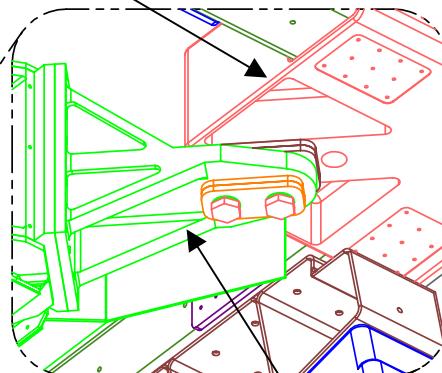
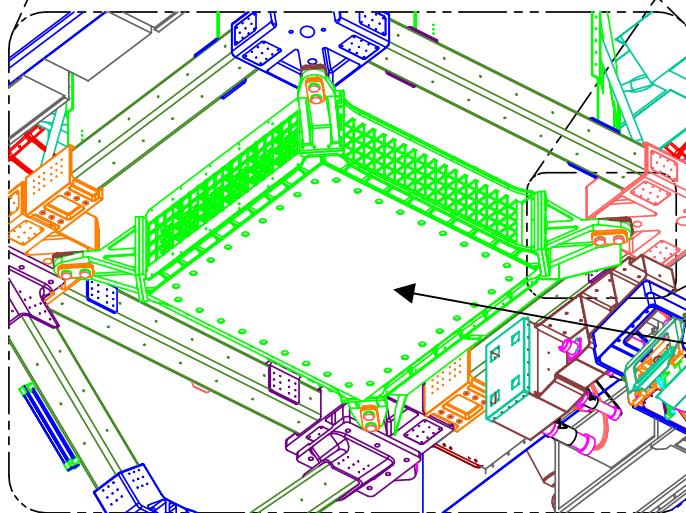




ECAL



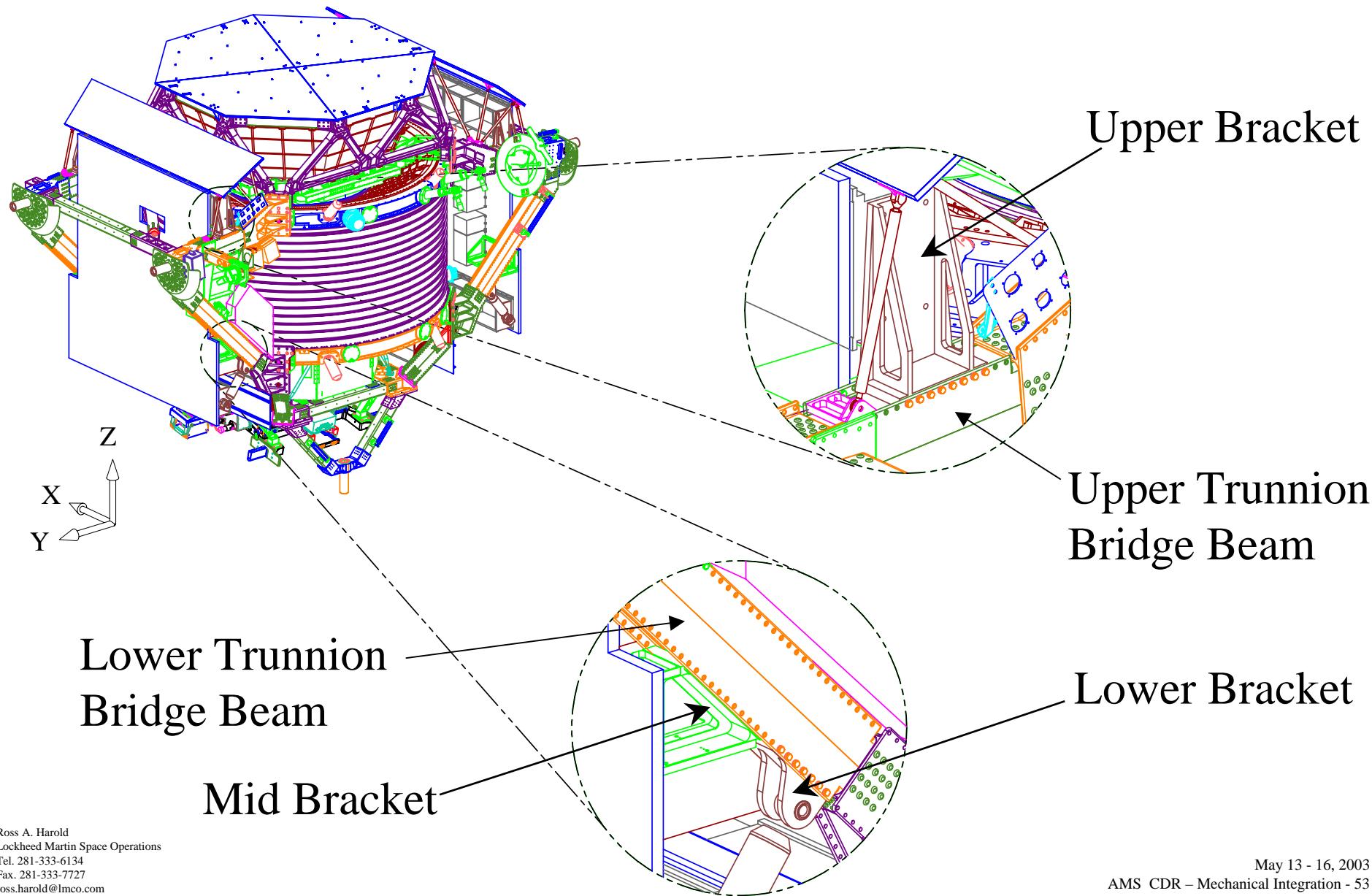
Lower USS Centerbody
Box Joint



ECAL mounting
bracket

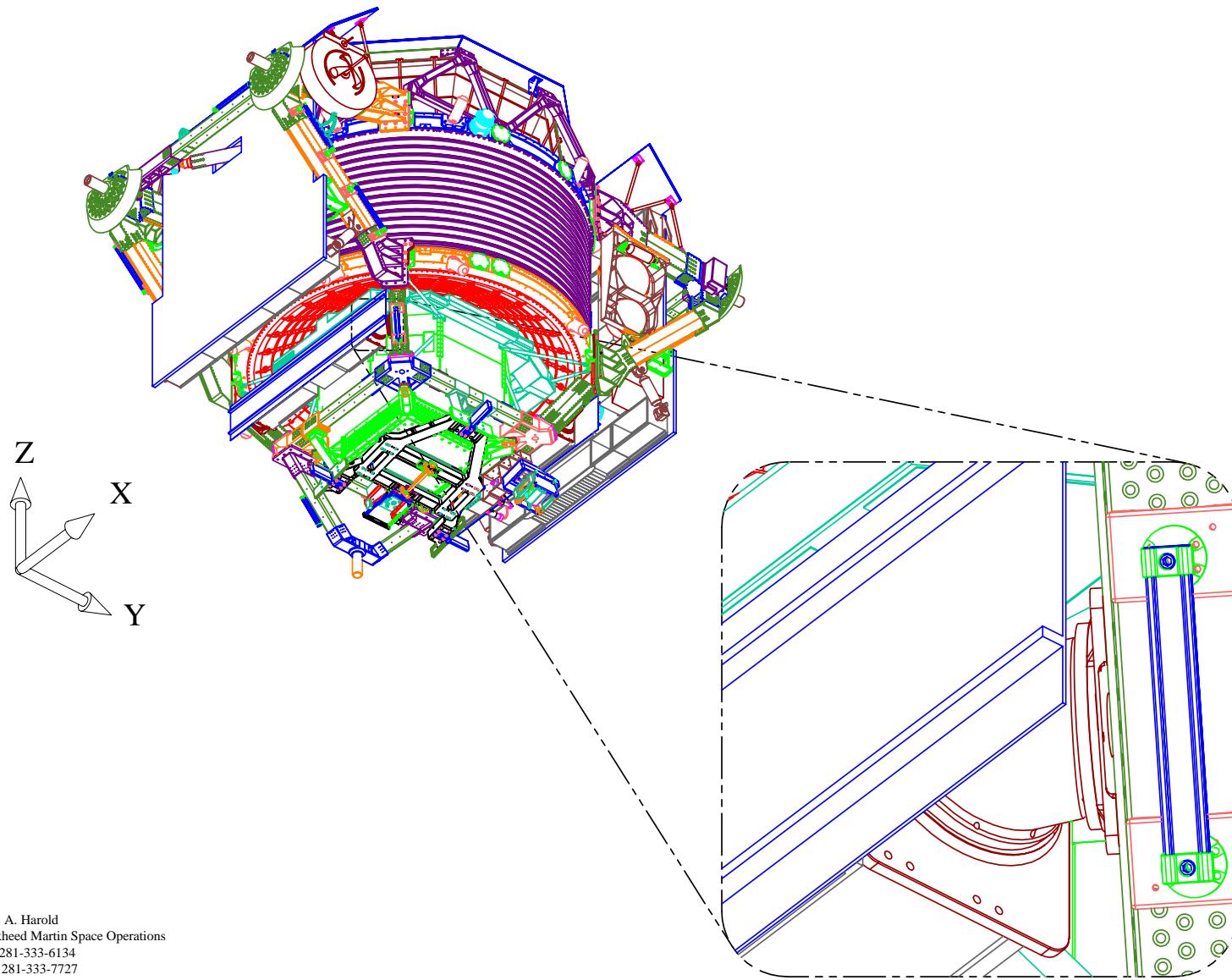
ECAL

Main Radiators + Crates



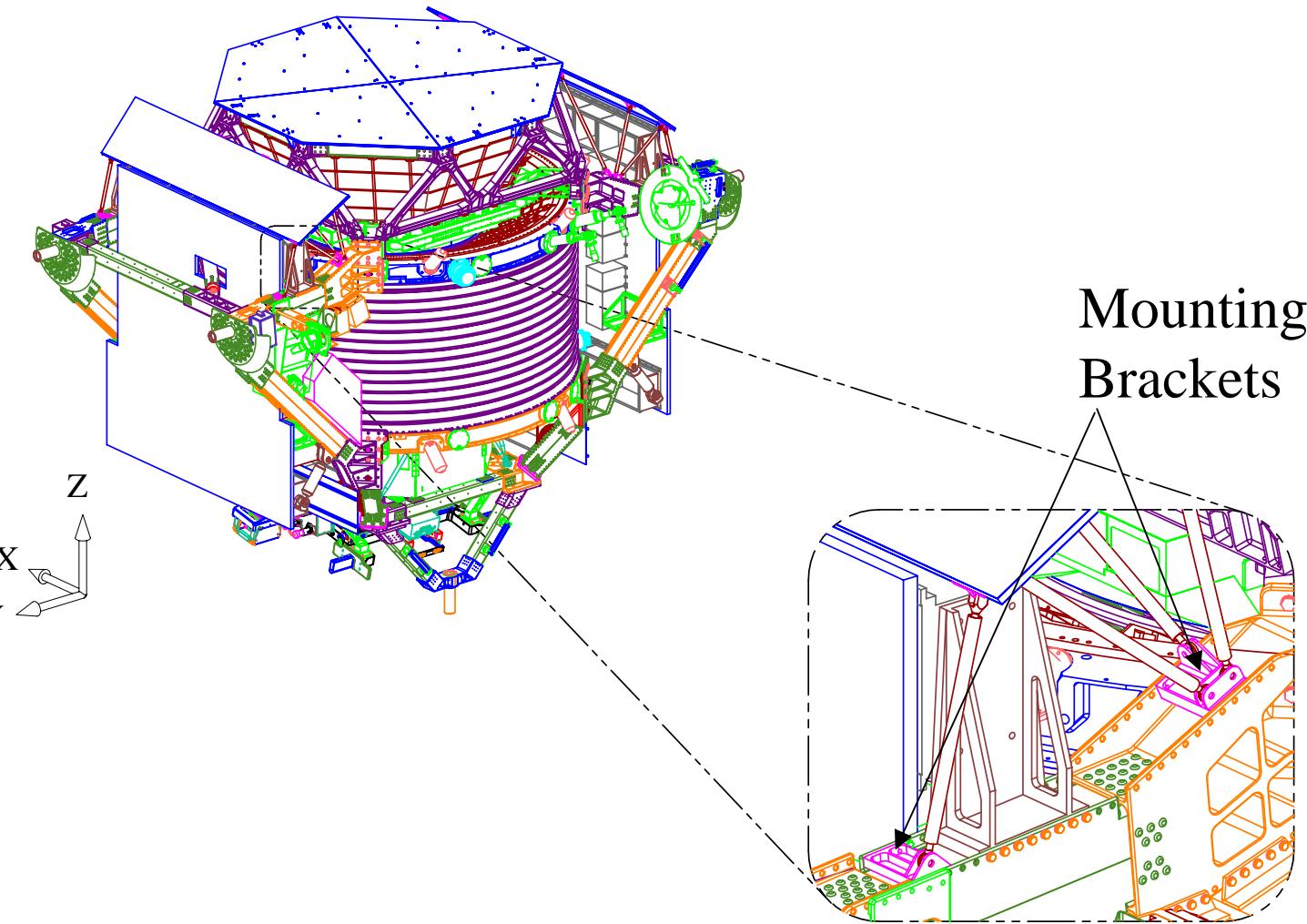


RICH & ECAL Radiators + Crates





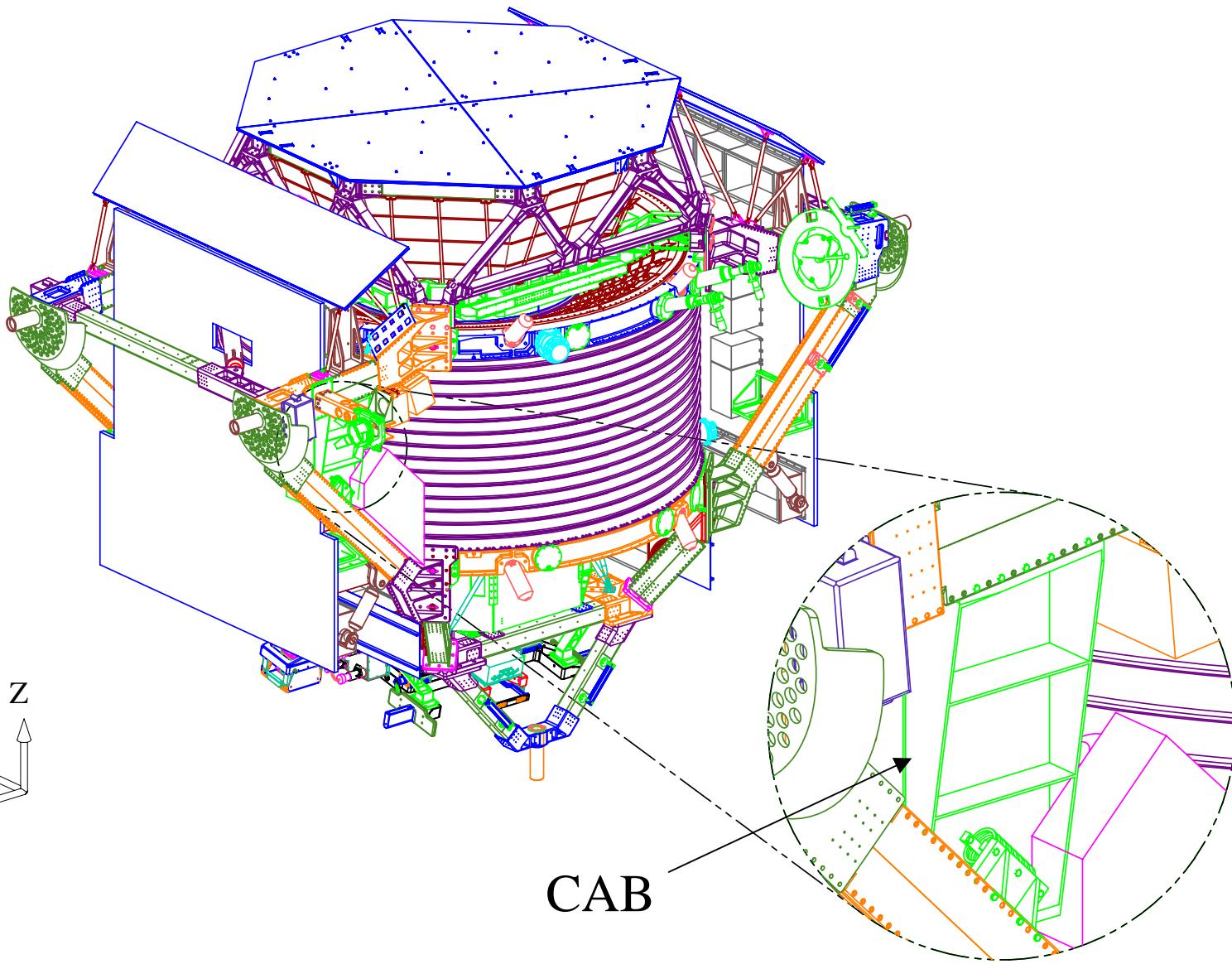
Tracker Radiators





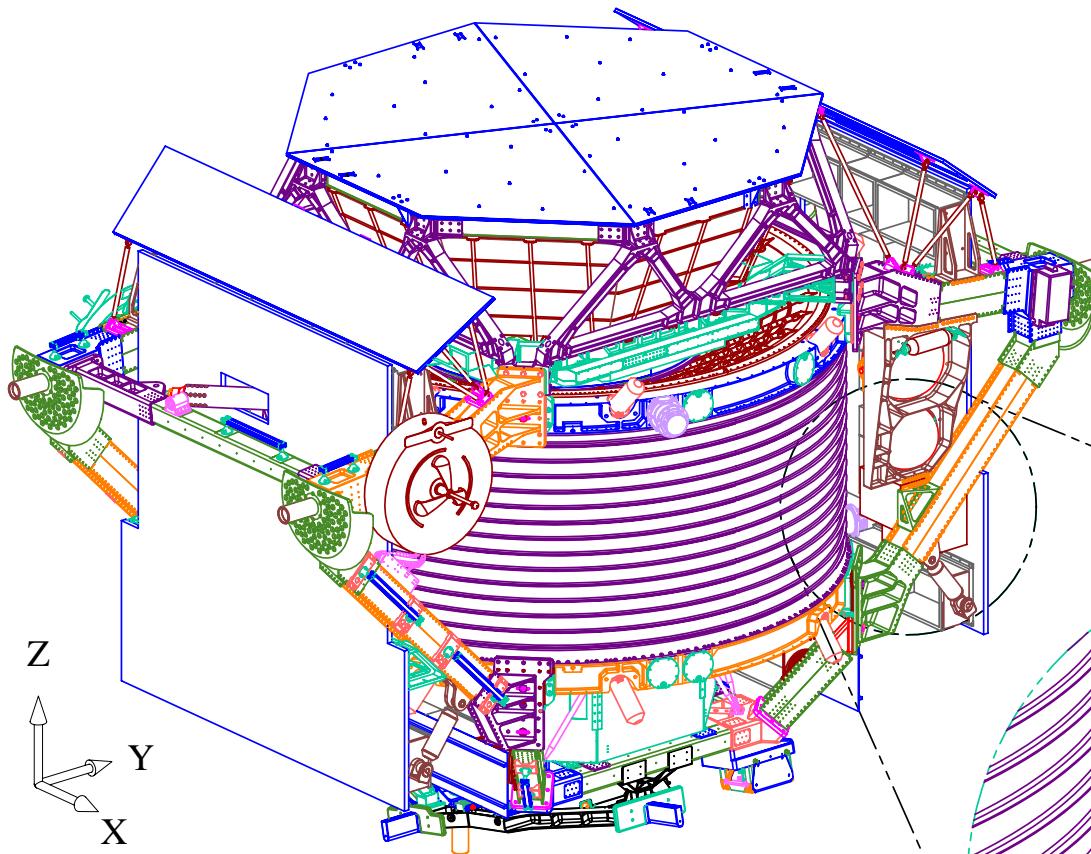
LOCKHEED MARTIN

CAB

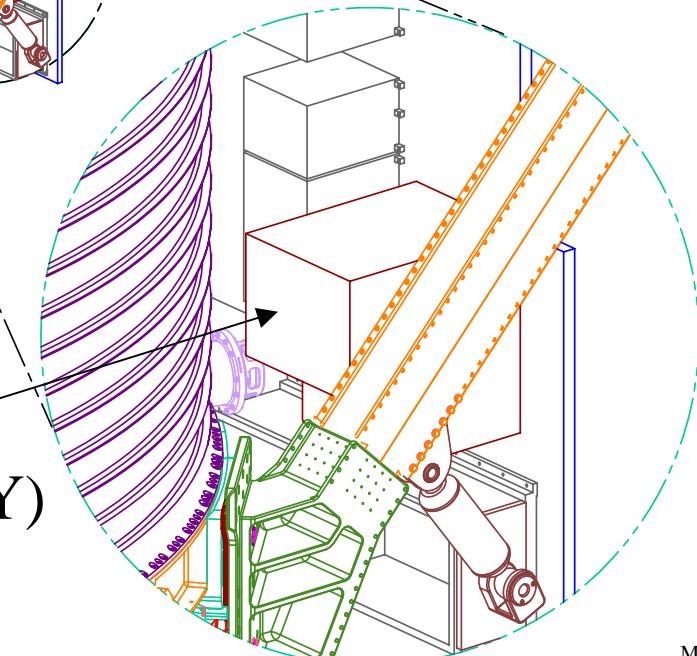


CAB

TTCS Boxes

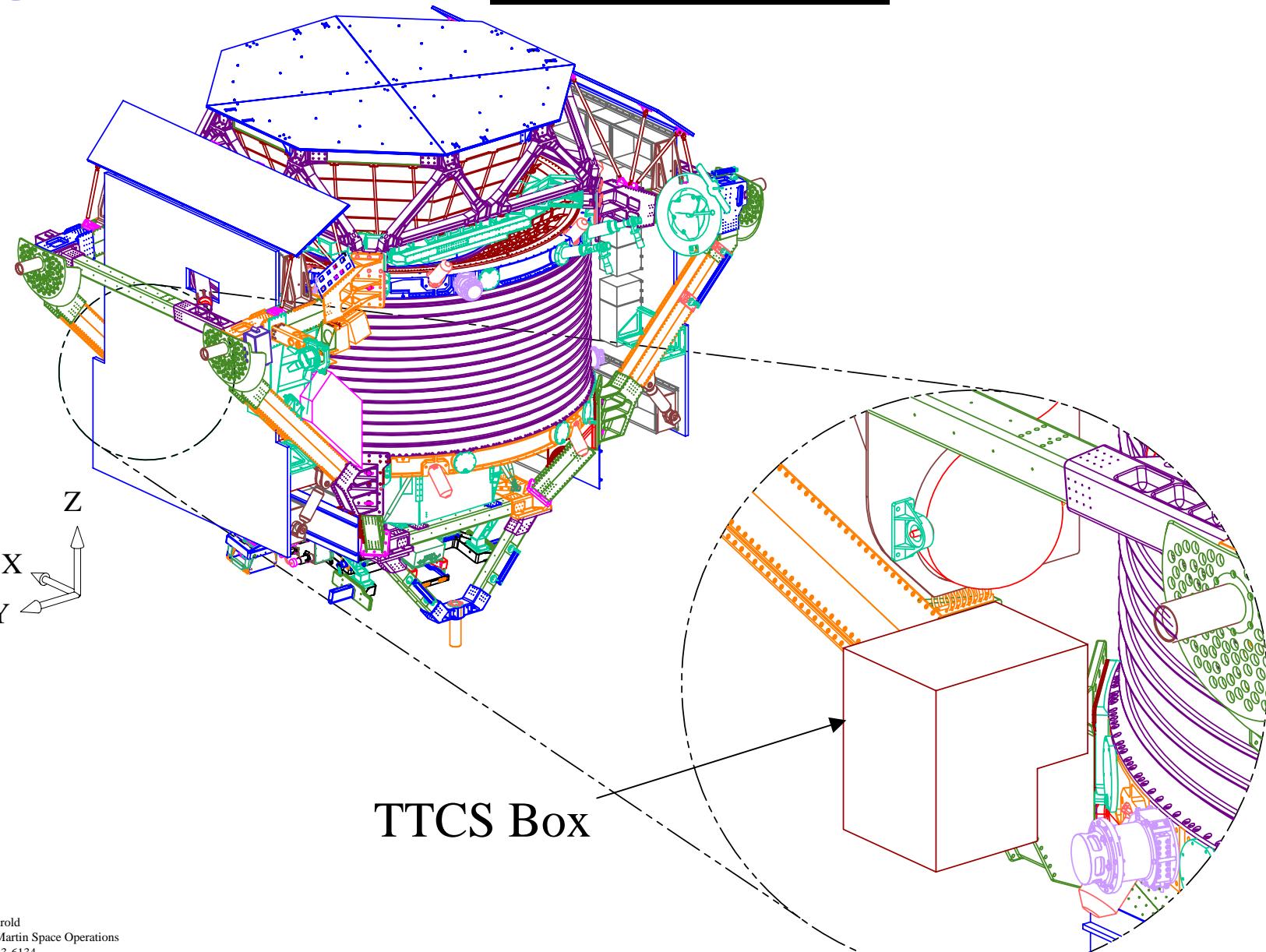


Tracker Thermal Control
Supply (TTCS) Box (+X, +Y)
Other box located (-X, +Y)



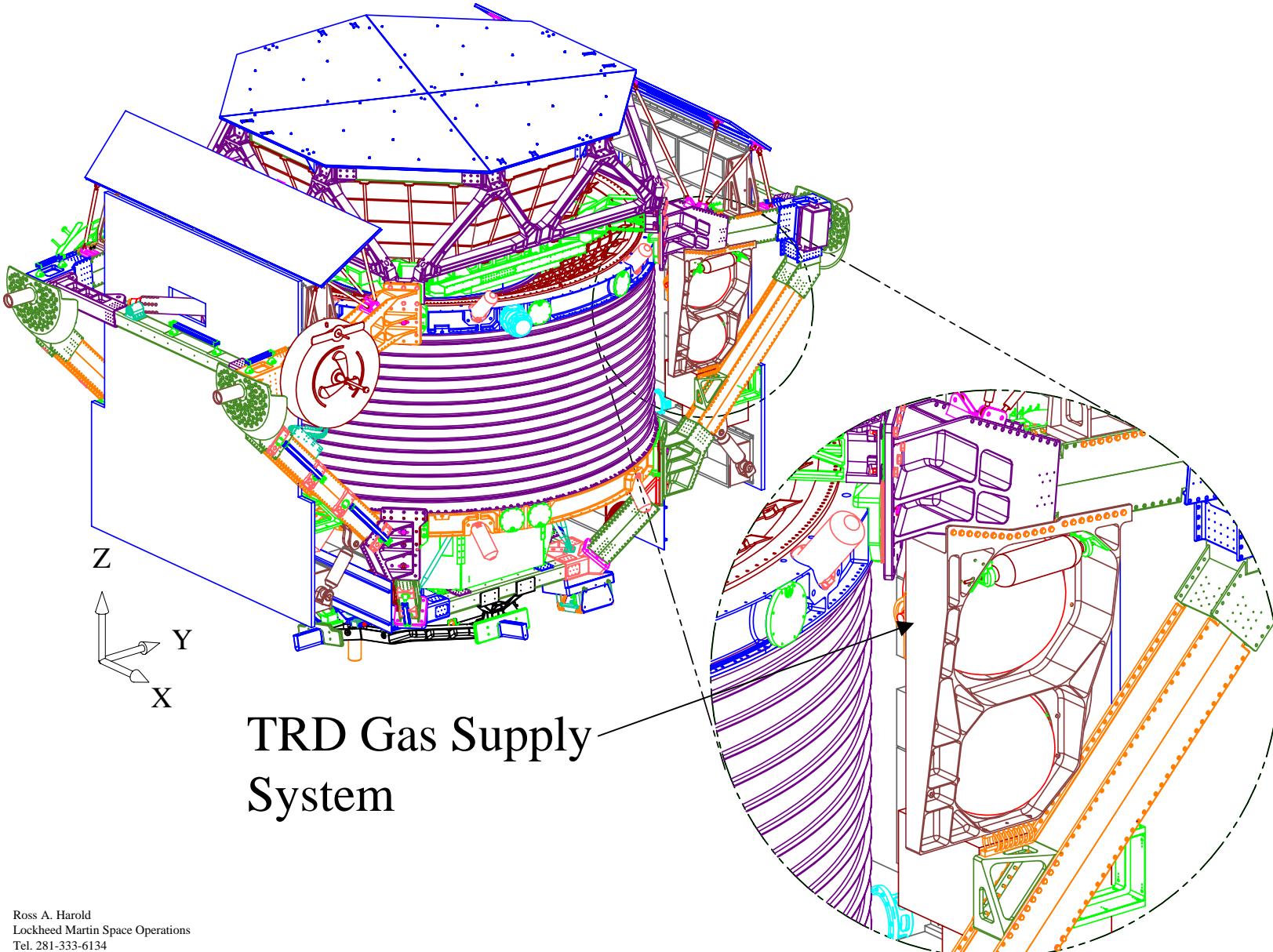


TTCS Box



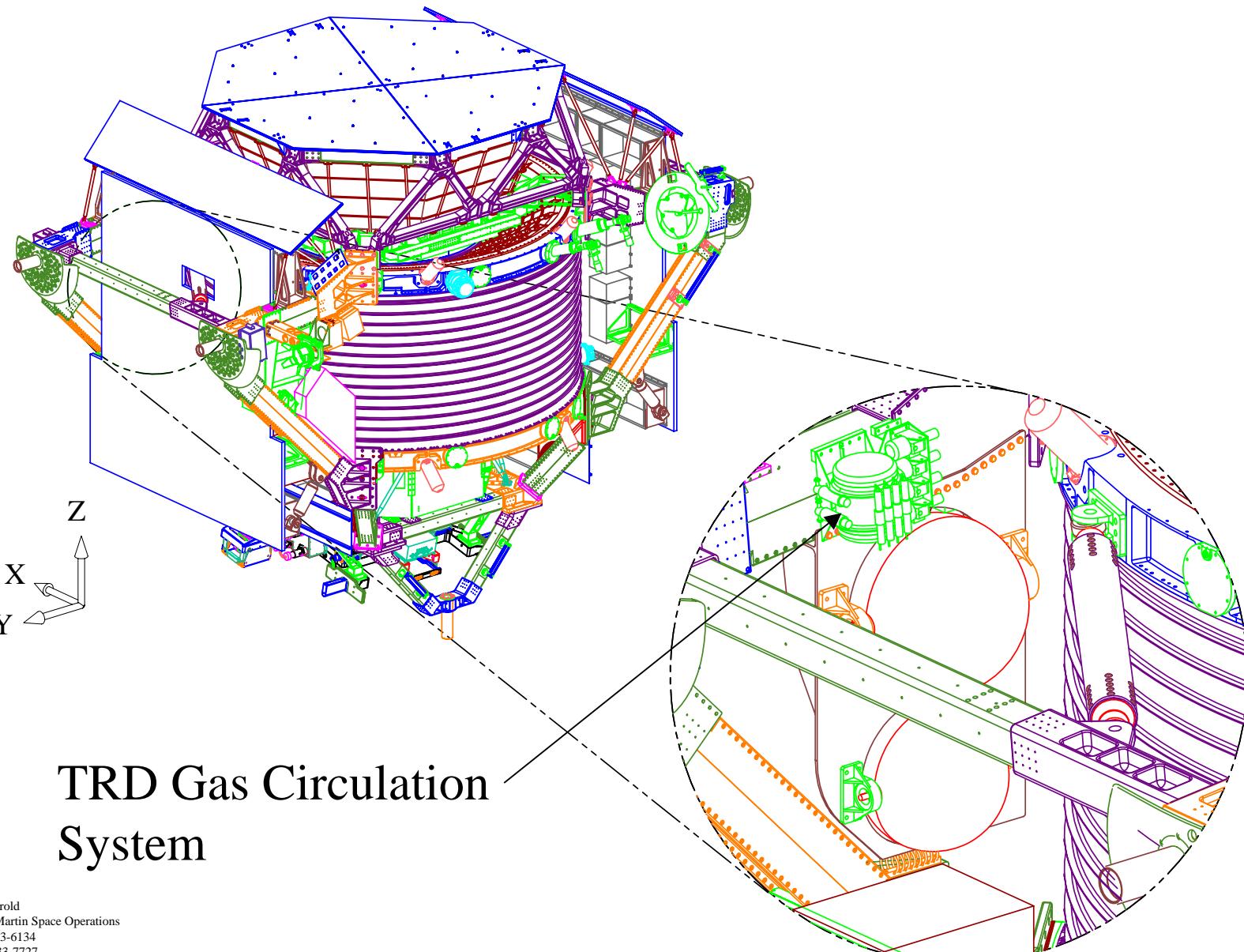


TRD Gas Supply System



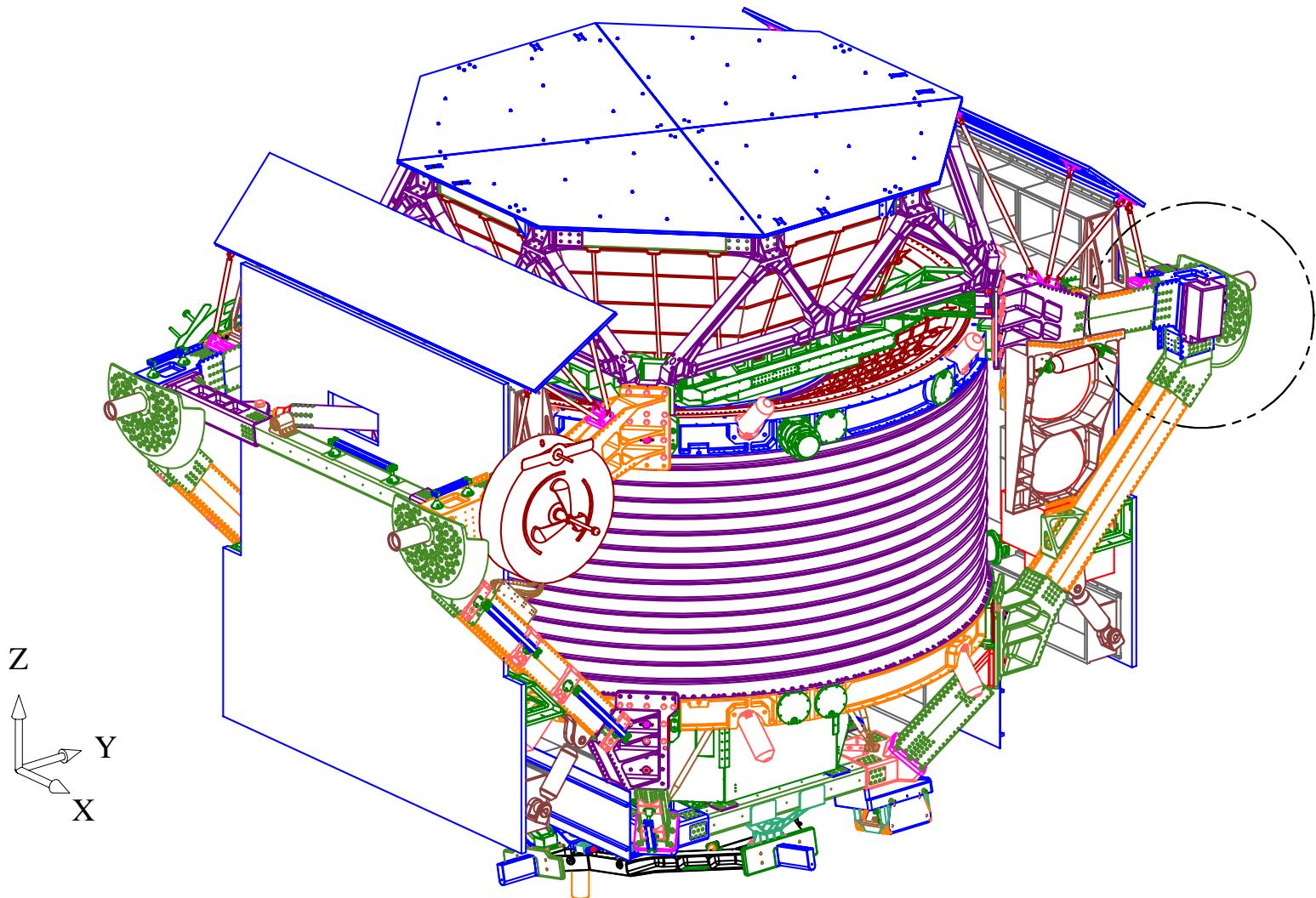


TRD Gas Circulation System

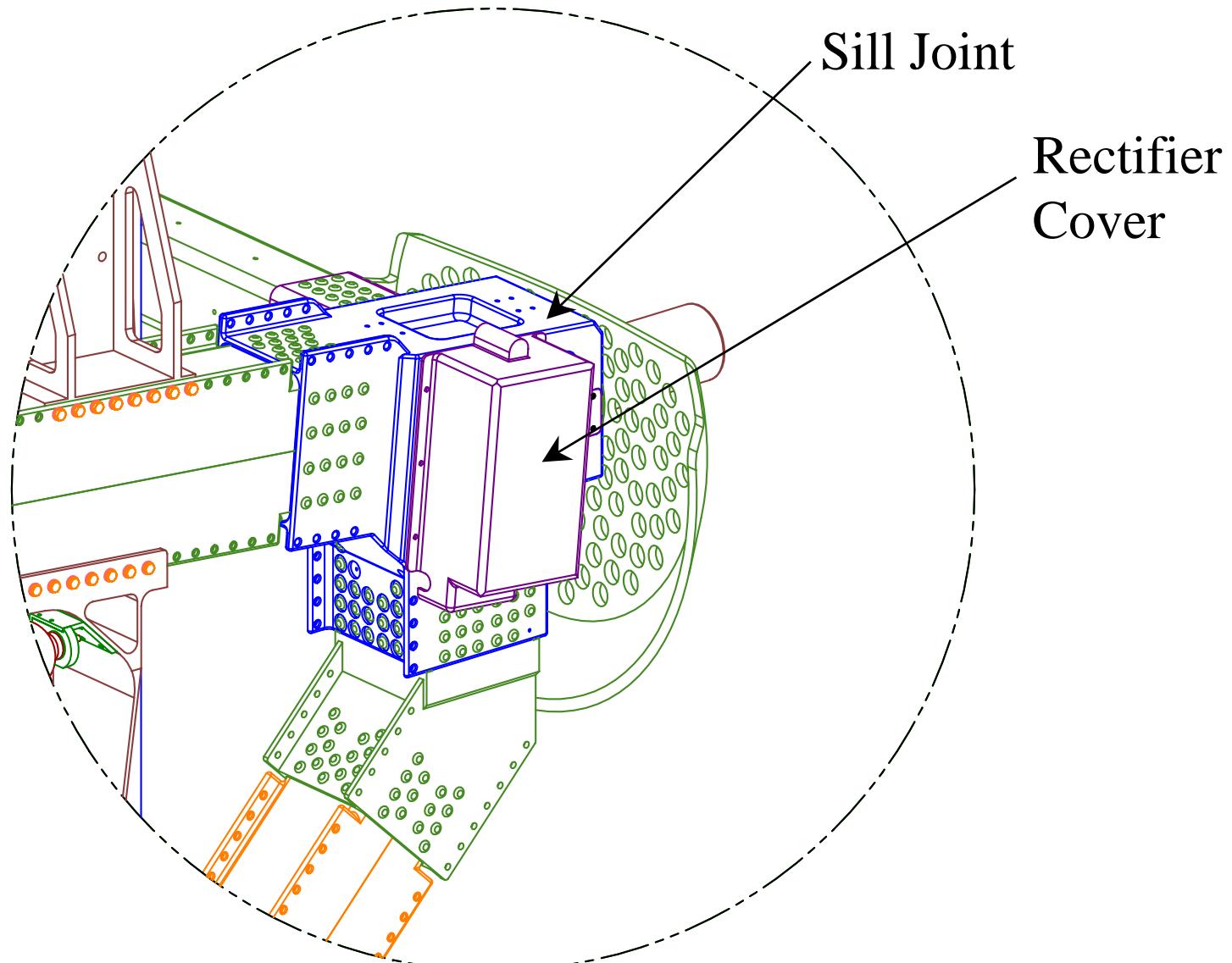




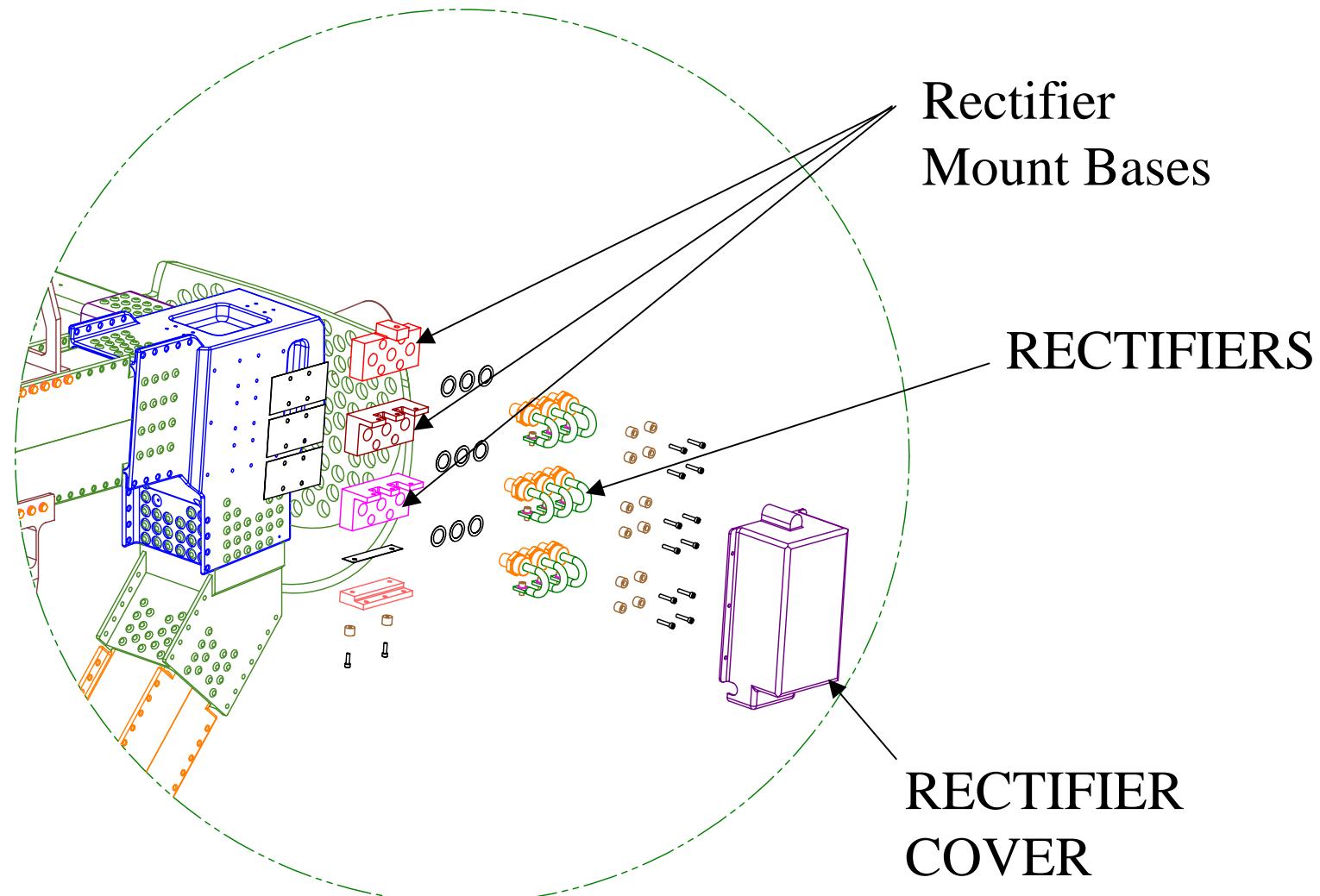
Cryomagnet Discharge System



Cryomagnet Discharge System

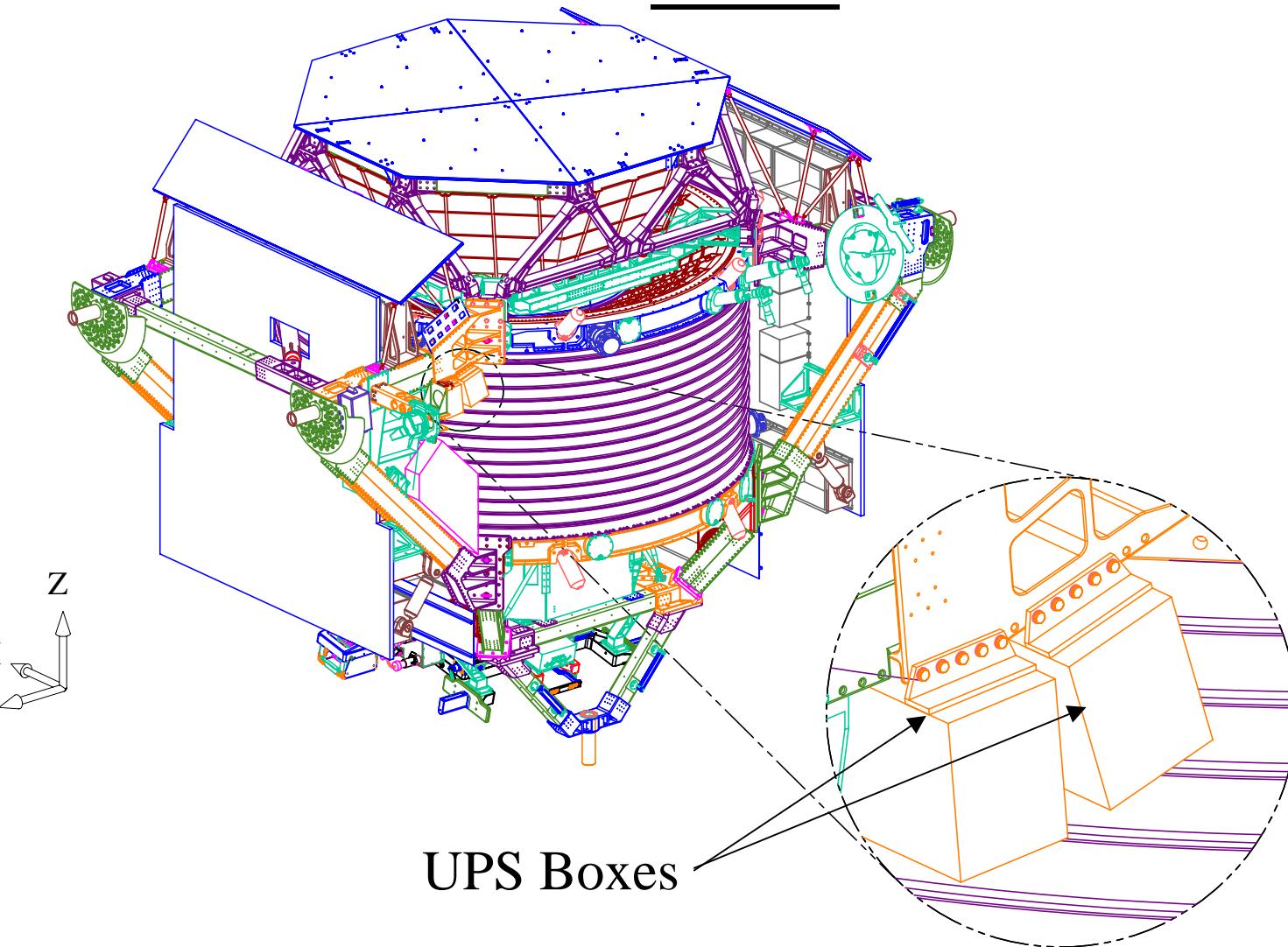


Cryomagnet Discharge System





UPS



UPS Boxes

CVB and Warm Helium Supply

Box

